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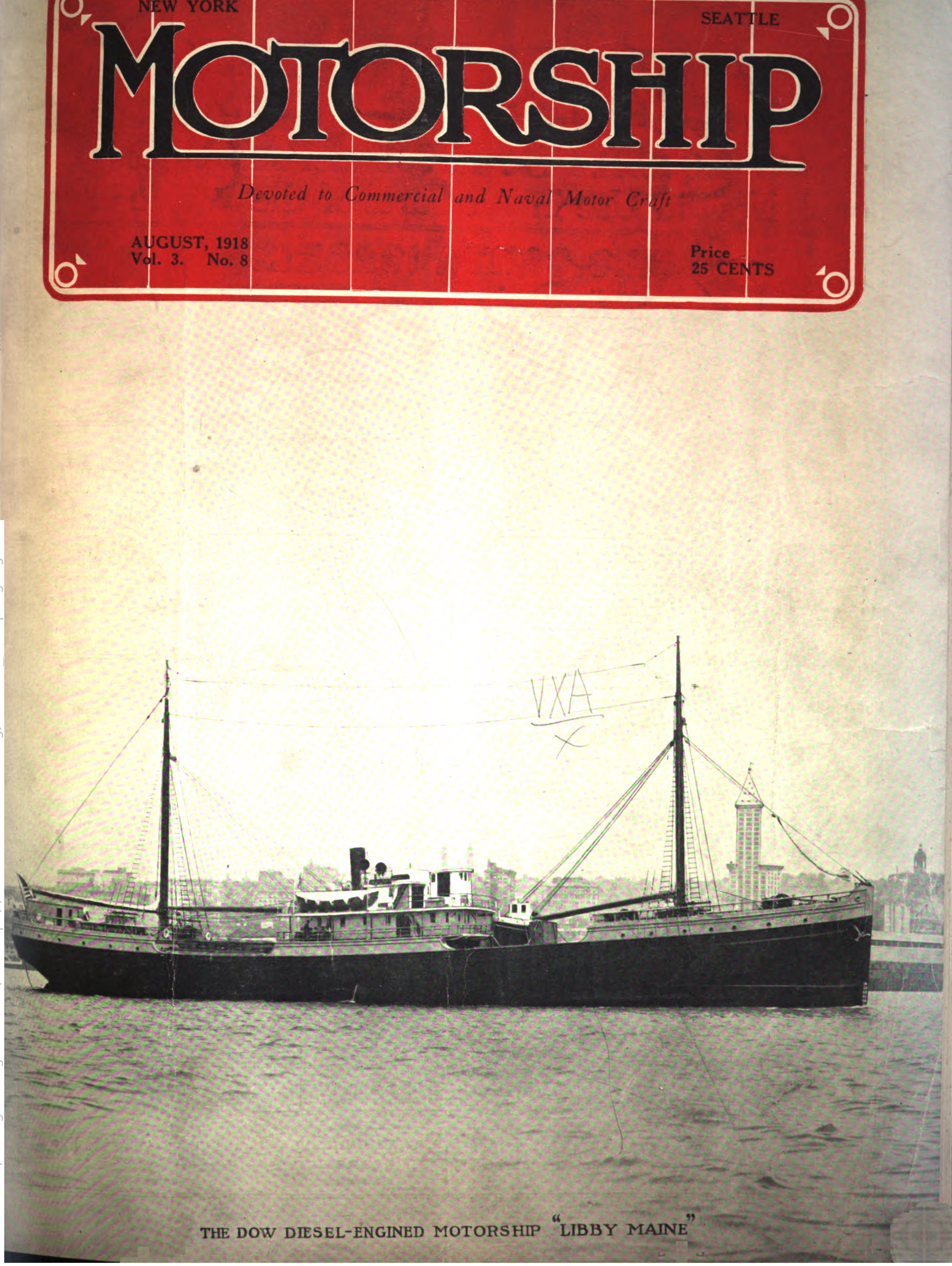

THE DOW DIESEL-ENGINED MOTORSHIP "LIBBY MAINE"

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MOTORSHIP

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EDITORIAL

The oil-engined motorship has arrived! It is such a pronounced economy that it was bound to come. Nothing could stop it! And all obstacles have been removed as fast as they arose. The law of progress has seen to that. Very strong prejudices stood in the way of steam. But, one after another they were swept aside and steam reigned triumphant for a century. Steam now has had its day! Its zenith has passed, and gradually but surely it is being superseded by the economical internal-combustion power. America, the most important oil-producing country, is to be the greatest motorship-owning nation. Let us all co-operate and assist to make that day soon

AMERICA'S NEW MERCHANT MOTORSHIP MARINE

ECCE SIGNUM! No more important and more significant action has been taken by the U. S. Shipping Board, and the Emergency Fleet Corporation since their inception than the recent decision to lay down at once a large fleet of merchant steel motorships, details of which "Motorship" is enabled to announce elsewhere in this issue, and the officials concerned are to be congratulated upon the splendid step taken, demonstrating the wisdom and foresight of the men selected to build up our merchant marine. Nowhere will the news be received with greater dismay than in Germany, because not only will these motorships be most difficult to intercept on the high seas during the remainder of the war, but during the trade "war" that follows they will be able to hold their own against the merchant steamships of Germany or of any other nation, by reason of their economy; also because they will be able to spend months trading in foreign waters without having to resort to the utilization of the coaling or oil-fuel stations of other nations, and so will not be hampered by high bunker coal prices, like at Suez, where the price recently was about $60.00 per ton. Thus these motorships virtually will be independent of all but our own domestic oil supply.

Unless these first thirty-six motorships are a failure (which we may pass aside as being of minute likelihood) the U. S. Government hardly can order further coal-burning or oil-fired cargo steamships of under 12,000 tons capacity after these first units have demonstrated their success, because of the enormous all-round advantages of motorships. This is why the initial step now taken is of vast importance to the United States. The American nation no longer desires the wasteful use of coal and oil under the boilers of steamships whether such ships are federal or privately owned, and we must make the utmost of nature's royal gift of oil to this country. Bunker coal interests can take considerable comfort in the knowledge that two hundred million tons of coal will make over five hundred million barrels of excellent tar-oil fuel for these Diesel-driven vessels, in addition to providing seven and a half million barrels of good benzol for automobiles and motorboats, also three million tons of valuable fertilizer in the form of sulphate-of-ammonia. While the oil companies can rest assured that when peace comes it will be very necessary for nearly all existing coal-burning vessels to be converted to residual-oil using internal-combustion-engine power. Thus everything automatically will right themselves in the best possible manner and all of us will gain in the end. Naturally "Motorship" cannot but help feeling very gratified that its strenuous efforts have not been in vain, and at last are well on the road to being completely realized.

With a great fleet of economical motorships, our merchants and manufacturers will be able to carry out enormous overseas enterprises and so enable America to become the greatest and wealthiest business nation in the world. This eventually will favorably reflect upon social conditions and will enable poverty to be driven almost entirely away. But if our steamships cannot be run at a profit in competition against other great nations after the war, the resultant severe internal competition will reduce wages and increase living costs. Thus, without an adequate and economical motorship fleet, all America's present efforts to build up a successful merchant marine would be in vain. So our hope rests with motorships!

SMALL MOTORSHIPS TO FETCH AUSTRALIA'S WHEAT

Desirability of Federal Subsidies to Encourage Immediate Construction of Such Vessels for That Purpose

APROPOS the U. S. Shipping Board's recent ruling, whereby domestic and foreign shipowners now may have built wooden motorships up to 1,000 tons d.w.c. in American yards, it perhaps is advisable for the authorities to advance a step further. Now lying in Australia, awaiting ships, are millions of bushels of wheat that are urgently needed by ourselves and Allies. Much of this wheat could be economically transported to America and Europe by a fleet of five hundred heavy-oil engined wooden and concrete motorships of about 1,000 tons d.w.c. each, and such a fleet could be constructed in the United States in private yards by private shipowners, without obstructing the present Federal shipbuilding programme.

(Continued on following page)

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But unfortunately private shipowners today do not know how they stand, so very few appear to be willing to risk their capital in building new ships at this time. Constructional and operating costs are at ther highest pinnacle, while freight rates have been cut by Federal authorities to a point where shipowners fear a loss if they order new bottoms at $150-$200 per d.w.c. ton.

Under the circumstances we believe that it is advisable for the U. S. Shipping Board to take a step further, in their recent encouragement of domestic private interests to build motorships of this size, by means of reasonable subsidies, and to encourage allied and neutral shipowners to place orders by guaranteeing that delivery of the ships will not be prevented by the U. S. Government provided the owners agree to make a certain number of voyages to Australia, or elsewhere directed by the Shipping Board.

There will be no difficulty in obtaining five hundred Diesel engines of 1,000 h.p. each, or one-thousand surface-ignition, or Diesel engines of 500 h.p. each to propel this fleet, from American marine engineering concerns. This would mean a fleet capable of carrying nearly half a million tons of cargo every one way voyage at 10½ knots average speed, on a total fuel consumption not exceeding 2,000 tons of oil-fuel per 24 hour day, and with a total crew of about 5,000 men. Thus, in no way will this proposed fleet be a drain upon American resources. Because of their small size such motorships can be built very rapidly.

After the war these ships can be used for trading between the United States, and the Dutch East Indies, to South America and Hololulu, or in the coastwise service, and at all times will be able to compete against large cargo steamers because of their economical operation.

The subsidies offered at the present time to domestic shipowning interests may well take the form of a grant of $50.00 per ton d.w.c., and $5.00 per ton of wheat delivered from Australia to the U. S. A., or $7.50 per ton delivered from Australia to Europe, in addition to the freightage. Doubtless the Australian Government would be only too glad to pay half such a subsidy in order to get shipped the vast quantities of wheat that have accumulated and which will be greatly increased by February or March next, when next season's crop has been harvested. Meanwhile, America is subsisting upon mixed cereal-and-wheat "bread" or upon rye bread. Let us commence this fleet of motorships now!

DID THE U-BOATS HEAR?

IT is to be hoped that the "detectaphones" of the German submarines caught the sound-waves from the great splash on July 4th last, when fourteen new 35-knot destroyers and 95 merchant ships were launched in American shipyards. Of the latter, 42 were steel ships of 287,464 tons d.w.c., and 53 wooden vessels of 187,000 tons d.w.c. Included were 11 ships, the launching of which on that exact day was prevented by floods.

STEEL—NON-ESSENTIAL ENGINEERING, AND—SHIPS!

ALL officers of engineering companies who possess a normal amount of patriotism and foresight, will take to heart the appeal to the United States recently made by Sir Joseph Maclay, the British Controller of Shipping, and will "do their bit" towards winning the war by acting upon his urgent request without waiting for the Federal pressure that otherwise eventually must come. Sir Joseph's principal remarks were:

"In America's shipyards lies her greatest opportunity to be of service to the Allies. We need American men, American munitions, American food, but first we need American ships, for without ships we cannot get American munitions and food, and without ships American men even in the battle line on this side easily might become a hungry peril rather than a safeguard to us."

"The German submarine has not been beaten and can be beaten only by increased protection for our shipping and increased tonnage of that shipping. That does not mean an increase of naval activity on your side or on ours. It means shipbuilding activity.

"Anything not intimately connected with and essential to the winning of the war, but which at the same time absorbs steel, is a peril to the winning of the war.

"If steel is used in any process but shipbuilding, save in some one of those others which are of comparable importance in the winning of the war, that use instantly should be brought to a full stop, no matter what may be the special interests unfavorably affected."

Undoubtedly Sir Joseph rings a true note. Too much steel is being wasted on non-absolutely-essential engineering work. Non-completion of many engineering undertakings will cause much inconvenience and perhaps a certain amount of financial loss; but they are only a few of the sacrifices we shall be called upon to meet before we and our Allies win the war. Let us face them now, for the longer the delay the greater will be the sacrifices. It is of no use postponing the inevitable!

It is time that the entire suspension of the manufacture of pleasure automobiles was called, and the men, machinery and steel thus occupied, utilized for the construction of marine engines, auxiliaries, and ship's fittings, etc. During the hot weather, a certain amount of automobiling is advisable, especially for men who are laboring under the severe strain of war-work. But there are enough pleasure motorcars in existence to keep the country going for at least a couple of years. We are at war and in it up to the neck! The sooner all of us realize it the better it will be.

There also are engineering works in this country turning out steel products of a heavier kind, including stationary-type Diesel and other land oil engines which, while more or less important, rank very much further down on the list of immediate essentials than do oil engines for ship propulsion. Most of these works could be utilized for building marine crude oil internal-combustion engines for steel ships, for concrete ships, for wooden ships, and for converting existing sailing-vessels into auxiliary craft. These firms should not be asked if they would or could undertake such jobs, but simply and quietly requested to do so. Finances can be adjusted later by the authorities, who should and no doubt will, be reasonably generous.

RELIABILITY OF AMERICAN-BUILT DIESEL ENGINES FOR TRANSATLANTIC WORK

DURING the early stages of the investigations being made by the United States Senate Committee on Commerce into the shipbuilding situation, the members were informed by one of our leading naval architects that American built marine Diesel engines were not reliable and had not proved their capabilities for transatlantic work.

Since it has transpired that a number of American-built and Diesel-engined submarines have crossed the Atlantic and have remained in service in the war zone, some of which crossed in the terrible storms of December last.

Now, we do not know if engine troubles developed during the voyage of these boats, and it would mightily surprise us if they hadn't. But no doubt the average performance was excellent if we may judge from reports, published, such as the following:

"Officers and men of the American submarines faced hard days as they put out. Cramped in narrow quarters, and with storms in prospect they steered to sea with complete confidence in themselves and their boats. In mid-December others got started. While it was fair on sailing-day, ahead of the submarines, a 100-mile gale was brewing. Into it they plowed, rolling and tumbling.

"But there was no faltering. The boats were going to the front in real warfare this time. A majority of them reached their destination under their own power, ready for duty.

"Some of the boats were driven far from their course. They showed up at different ports, but promptly put to sea again and reached their station.

"One boat was the hard-luck vessel of the lot. Separated from the flotilla in the first storm and its compasses out of order, it turned homeward, only to strike two more gales in quick succession. However, it made port successfully and undamaged. With new fuel and supplies aboard and with a man or two, worn out by the long struggle with the elements, replaced, in a few days the boat put to sea again. It went through that time, despite a fourth gale it encountered."

How true the above account may be we cannot say; but it is obvious that the Navy Department must have felt satisfied that the Diesel engines of these submarines were reliable, otherwise they would not have been sent so far away from their home bases. This is not the first time that American-built Diesel-engined submarines have crossed the Atlantic, as about half a dozen cruised to England and to the Mediterranean during the early stages of the war.

The high-speed, light-weight submarine-type is far more liable to trouble than is the slow-speed, heavily-constructed Diesel engine of a cargo-ship or tanker.

The high-compression used in the Diesel cycle really offers no serious difficulty to engineers, the real cause of occasional non-reliability being the heat-stresses that are set up in the castings. With a high-speed engine, the number of heat-units that have to pass through the cylinder walls and to be carried away by the cooling-water in a given period of time are three times those of a slow-speed engine. So, if a high speed submarine Diesel engine is reliable, we can rest assured that the heavy duty mercantile engine even is more reliable.

WERKSPOOR REPRESENTATION

MR. T. ORCHARD LISLE, who for many years was the U. S. A. representative for Werkspoor of Amsterdam, has resigned from his most pleasant business relations with that well-known company in order to devote his sole time to editing MOTORSHIP and to encouraging progress of the marine internal-combustion engine in the U. S. A. and to assisting the United States in winning the war and preparing for after war trade.

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The Dawn of America's Mercantile Supremacy

U. S. Emergency Fleet Corporation Orders Thirty-six Diesel-Driven Twin-Screw Steel Cargo Motorships of 7,100 Tons Displacement Each

By the Editor of "MotorshiP"

(Passed for Publication by the U. S. Emergency Fleet Corporation)

NEVER have I commenced an article with greater enthusiasm and pleasure. It is to make the important announcement that the U. S. Shipping Board, Emergency Fleet Corporation has decided to at once build thirty-six Diesel-driven steel motorships of special design and of considerable size, and that these undoubtedly will be followed by many more vessels, larger, perhaps, but also motor driven, and which may be in sufficient numbers to make the first order seem but a spot on the ocean in comparison. No greater blow could be given to Germany, as it is a deep thrust that will inflict a permanent wound and which for many years will hamper her overseas trade after the war.

Every assurance and effort has been taken by the technical division of the Emergency Fleet Corporation to insure that these ships will be completely successful. For this first fleet it was decided to take only machinery of established design and proven reliability; but, of course, the turn of oil-engines of domestic design will follow later. This is in the best interests of American engine designers and builders, because the failure of an untried design, if adopted, doubtless would seriously jeopardize further motorship progress and construction by the Government, so the fewer the risks taken now the better it ultimately will be for all concerned.

Deep investigations and studies into the motorship and Diesel engine subjects have been made by the officials, including Mr. D. Cox of the steel construction department and by his right-hand man, Mr. L. Prior, a level-headed Navy Department naval architect, not to overlook the untiring efforts of Mr. Hubert Verhey, chief of the Diesel engine department, who has done a mountain of work aided by his assistant, Mr. Morton. In close co-operation with Mr. Verhey has been Mr. Arthur West, a 'dollar-a-year man who is one of America's finest internal-combustion engineers. Then we have Mr. Sadler, the naval architect of the Emergency Fleet Corporation, and Mr. Haag and Mr. Robertson; the latter, we understand, together with Mr. Prior, being mainly responsible for the unique design of the hull of these motorships. Finally Messrs. Charles Schwab, Edward N. Hurley and Chas. Piez and others of the Board must be warmly congratulated for having approved of the new programme.

We also will mention that another department of the Emergency Fleet Corporation have something very extensive under development in the way of motor vessels, but the time has not yet come to give details. We will give these later. Also the Shipping Board recently took over the Dutch tanker "Poseidon," which is equipped with a Werkspoor Diesel engine and reversible propeller. Coming on top of the U. S. Shipping Board's announcement to permit private construction of wooden motorships for foreign and domestic owners, the splendid news of this excellent start in the way of steel motorship construction will cheer the hearts of many of the heavy-oil engine world and doubtless will cause the entry of additional new comers into the industry. Especially as the Water Transport Division of the War Department intend ordering some Diesel-driven transports of 7,000 gross tons. There is room for all responsible concerns, because there are big things in view for America's oil engines builders, and the marine oil engine business soon will be one of our largest industries.

Now to the new twin screw motorships. They will be of unique steel structural construction, and will be fabricated in inland shops and erected on the Pacific and Atlantic coasts. Orders for sixty-two reversible Diesel residual-oil engines of 750 shaft-horse-power each, for these vessels already have been placed, twenty on the Pacific coast and fifty-two in the East. This constitutes a record order for marine Diesel oil engines. It is the Emergency Fleet Corporation's intention to provide steam installation in a few ships of the same design as the motorship. I sincerely trust that steam will not be considered for many of them, there already being enough steam-driven craft under construction.

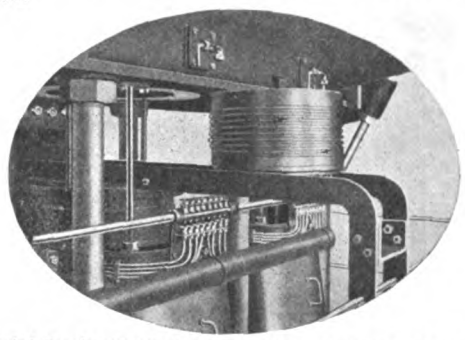
While I am not yet privileged to publish plans and sections of the hulls, but in the next issue I hope to give an illustration that will afford a good idea of how these motorships will look when afloat. They will be of box-like construction without curves and will be funnelless, with very little superstructure, and will have collapsible masts. Forward of amidships is the chart-house and bridge, while aft of amidships are the officers' quarters and radio station. Mounted fore and aft respectively will be two 5" guns. When camouflaged it will be most difficult to see these ships at a distance. Even at close quarters the stem and stern are so much alike that the observer will not know if they are coming or going. Thus they will form a very difficult target for the submarine to hit even if seen by the latter, while they will have no smoke to betray their presence to the enemy at a distance. All the auxiliary machinery will be electrically driven. All the main Diesel engines and auxiliary oil engines are due to be completed and delivered within a year, and the first engines are expected to run trials in about six months' time.

The dimensions of these motorships are as follows:

Displacement (loaded)	7,100 tons
Dead weight capacity	5,000 tons
Length (overall)	344′ 9″
Length (between perpendiculars)	333′ 0″
Breadth	46′ 0″
Molded Depth	29′ 9″
Draught (loaded)	21′ 0″
Shaft horse-power	1,500 b.h.p.
Indicated horse-power	2,000 i.h.p.
Length of engine-room	47′ 3″
Number of propelling engines	2
Number of cylinders per engine	6
Speed (loaded)	10 to 10½ knots
Daily fuel consumption of main engines	about 6½ tons

Fuel will be carried mainly in the double bottoms of the hull, six compartments holding 793 tons, the fore peak 84 tons and the after peak 99 tons; this total of 976 tons I estimate to be sufficient to run the main engines for about 150 days and nights, or say, 38,800 miles. But I presume that one of the two auxiliary heavy-oil engines will be operating continuously, which will mean an additional daily consumption of about one ton. However, the deep tank has an extra capacity of 466 tons of oil fuel or can carry 13,900 cubic feet of cargo. In the case of the Diesel-engined ships I doubt if the deep tank ever will be used for fuel oil, at least, only under exceptional circumstances.

As it is, these motorships will not need more than 300 tons of fuel for a return voyage from New York to France, which means that if the deep tank is used for cargo and all the other tanks for oil, each vessel will be able to discharge not less than 650 tons of fuel-oil when in Europe, thus performing a doubly valuable service. If the deep tank is used for carrying oil, then over 1100 tons of fuel can be discharged at a European port. After the war, how can steamers compete with such useful and ecomonical craft?



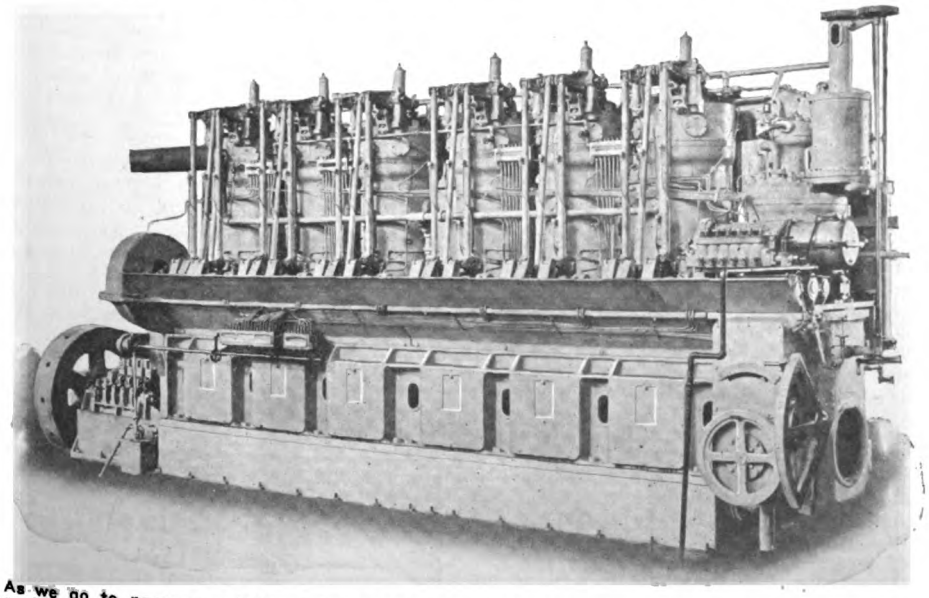
Special Device for Quick Inspection, or Removal, of the Pistons of the Werkspoor-Diesel Engines to Be Built by the Skandia Pacific Oil Engine Co.

Twenty-six of these motorships will be equipped with McIntosh & Seymour-built Polar-Diesel engines, and ten ships will have Skandia-built Werkspoor-Diesel engines, all of the single-acting, direct-reversible, four-cycle type. However, the first named will be of the trunk piston, box-frame class without crossheads and guides; while the latter will be of the box-piston, open-frame design with crossheads and guides. The behavior of these two distinct designs of four-stroke-cycle heavy-oil engines in exactly similar hulls will afford the Government a wonderful opportunity of making comparisons under sea-going conditions. I also hope that the Emergency Fleet corporation will order some two-cycle Diesel-engined ships for comparison purposes. The McIntosh & Seymour engines will have cylinders 22″ bore by 32″ stroke and will turn at 130 R.P.M. and will have a weight of about 100 tons. The Werkspoor cylinders will be 20½″ bore by 35½″ stroke and will turn at about the same speed, or a little lower, and will have a crank-shaft diameter of 12⅝″ and a total weight, with flywheel pumps and compressors, of 96 tons. It is obvious, of course, that both engines have considerable reserve power. Both makes of engines will be six-cylinder models.

McIntosh & Seymour of Auburn, New York, who have received the order for 52 Diesel engines, are the sole American licensees of the Atlas Diesels Motorer of Stockholm, Sweden, builders of the Polar-Diesel Engine, while the Skandia Pacific Oil Engine Company, who have received the order for 20 Werkspoor-Diesel engines are one of the four U. S. A. licensees of the Nederlandsche Fabriek van Werktuigen en Spoorweg Materieel (better known as Werkspoor) of Amsterdam, Holland. In both instances experts have been obtained from the designer's works to assist in the production of the first engines of this motorship fleet. A brief technical description of both engines will be of interest.

The McIntosh & Seymour Design

Turning first to the McIntosh & Seymour engine, I presume that semi-steel will be used for the cylinder castings, as with the 500 b.h.p. unit, instead of cast-iron, the usual metal for Diesel cylinders. I also presume that the same pressure for cylinder compression and fuel injection, namely 480 lbs. and 850 lbs. per square inch respectively, will be adopted. The flywheel



As we go to press no photograph, of the type and size of the McIntosh & Seymour Diesel engine of which 26 pairs are to be built for the U. S. Government, is available. The above illustration depicts a 500 b.h.p. McIntosh & Seymour marine Diesel-type oil engine.

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will be arranged aft of the Kingsbury hydraulic thrust-block, instead of being coupled close to the engine frame. In order to standardize the construction of the ship as far as possible, the Skandia Pacific Company will arrange the fly-wheel of their engines in a similar manner. I see no reason why it should not "pan-out" very well, as it takes away a certain amount of pressure and wear from the after main bearing of the engine. The cast-iron framing that carries the cylinders is of the box, or enclosed, type, and is mounted on a heavy square-shaped cast-iron bed-plate. Light metal doors are provided on both sides of the box-frame permitting access to the crank-chamber and bearings. The cylinders have separate heads and are fitted with removable liners, so that the cylinder casting itself is of simple form, especially as all the four valves are carried in the head. These, of course, are the fuel, air-starting, exhaust, and air-inlet valves. There also is the little automatically operated compression-relief valve, which blows off when any abnormal pressure accidentally occurs.

On the cylinder covers are brackets carrying the valve-operating rockers, the rockers being actuated by long push-rods, made of steel tubes, and carried from the camshaft, which is arranged on the crank-chamber housing on the front of the engine. This camshaft is driven by a chain of gears off the crankshaft at the after end of the engine.

Running parallel with, and on either side of, the camshaft are two layshafts and these carry link-pieces, which are connected with the toes of the feet of the valve push-rods. The heels carry the rollers for running on the cams that lift the push-rods, and in turn rock the levers and depress the valves. In order to bring the astern cams under the rollers the camshaft is moved in a fore and aft direction and this is accomplished by turning the hand-wheel. The latter connects with a ratchet device that carries a curved diagonal slot in which is carried the lower end of a fulcrumed lever, the upper end of which is fixed to the camshaft, so that as the ratchet-device is raised or lowered by the turning movement of the hand-wheel the camshaft is moved fore or aft as the case may be. Other controls, such as that operating the link-pieces which decide the position of the feet of the pushrods, are interlocked. The outer lay-shaft carries the link-pieces for the inlet and exhaust valve actuating mechanism, while the inner layshaft carries the link-pieces for the fuel-injection and air-starting actuating mechanism.

There is a separate fuel-pump for each cyinder, and this pump-set is arranged on the front of the engine at the forward end just over the camshaft. Governing is arranged by varying the length of the strokes of the pumps. There is a double eccentric, that is to say one eccentric inside the other, one eccentric providing the motion for working the plunger and the other for varying its travel. The three-stage air-compressor together with its inter and after coolers, are situated at the forward end of the engine. It is direct driven from the crankshaft. Force-feed lubrication has been adopted, and the cylinders, piston-pins and compressors are lubricated by the Richardson-Phenix force feed oiler. This is driven by timing gears, so that the oil is delivered to the working parts during the part of the cycle when it gives the greatest benefit.

The Skandia-Werkspoor Design

We now come to the Werkspoor-Diesel design which follows steam-practice. Accessibility has been brought to an unusual condition by reason of it being quite of the open crank-pit type, with the cylinders mounted on steel columns, etc., while strength and rigidity are added by steel cross-stays, with the crosshead guides on cast-iron frames at the back of the engine. To a light "frame" on the steel columns detachable steel plates are fitted to prevent lubricating-oil being thrown out by the rods. The six working-cylinders are divided into two sets of three, with the camshaft driving-gear and all the control levers between. The camshaft is operated by cranks and by long hollow, split steel tubes that pull but never push.

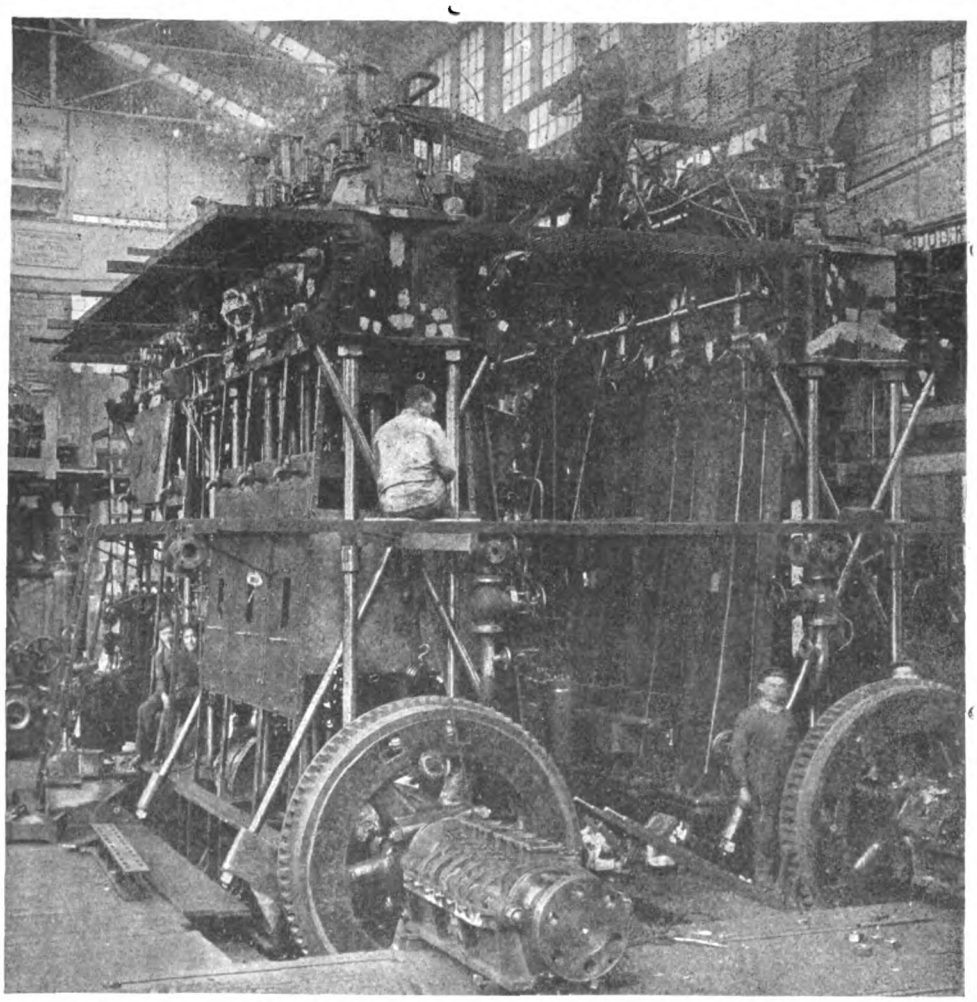
The cast-iron columns at the back of the engine are not bolted to the cylinders, but have a sliding-surface fit. Their chief function is to carry the crosshead guide, and the bearings for the beam levers of the air-compressors and cooling pump. With the idea of doing away with leaky joints often met with where coils are used for air coolers, the cooling chambers are special cast-iron boxes, with a simple valve that requires no spring.

The cylinder proper is separate from the outer jacket, which is a simple box-casting that virtually forms a tank into which the cylinders are dropped and secured in position by studs. This method enables the cylinder liner to be cast integral with its head, and affords a complete circulation of water round the upper part of the sides of the combustion chamber as well as on top. This gives water cooling exactly where it is needed, because it is there that the greatest centre of heat occurs. By offsetting the fuel-valve, at least four inches of water space is made around each valve. There are no cylinder-jackets in the ordinary sense of the term.

The portion of the cylinder which extends below the box is detachable and may be unbolted, thus facilitating the removal of any piston without dismantling any portion of the engine. The short box-type pistons are salt water cooled by means of non-touching telescopic tubes, without glands and stuffing-boxes or swivel joints. There is about one-half inch clearance between the tubes that carry the salt water.

One of the most interesting features of these Werkspoor engines is that the new system of reversing mechanism will be adopted and the old system of a double camshaft will not be used because of the simplicity of the new patented design. There is only one camshaft and this carries the cams for the ahead and astern motions side by side. The rockers that operate the valves are eccentrically and diagonally mounted on the rocker shaft. Thus by giving the latter a slight twist, the valve ends of the rockers are raised, moved and gently deposited on the adjoining set of cams.

With regard to the auxiliaries. At the time of writing these have not definitely been settled. But it is expected that each ship will have two auxiliary heavy-oil engines of 200 b.h.p. each coupled to electric generators and to spare air-compressors. One of these will be run at sea and both when discharging and loading cargo. The generators will provide electric current for electric light and all the minor auxiliaries. In addition there will be a 5 to 10 h.p. oil engine-driven emergency air-compressor set, and on deck there will be a combined wireless and emergency lighting plant. T. O. L.



A pair of Werkspoor-Diesel-type marine oil-engines of the same size as the 10 twin-screw sets to be built by the Skandia-Pacific Oil Engine Company for the U. S. Emergency Fleet Corporation. The pair illustrated, under sea-going conditions, together average 2,000 i.h.p. (1,500 b.h.p.) at 105 R.P.M. Their maximum rated power for continuous operation is 1,100 i.n.p. (825 b.h.p.) each at 130 R.P.M.

CROSS-CHANNEL MOTORSHIPS

There shortly will be placed in service between England and France three Diesel-driven motor-vessels, which will be American built and engined. In these vessels Winton & Southwark-Harris Diesel-type heavy-oil engines will be installed, and they will be of between one and two thousand tons dead-weight capacity. By reason of their special design they will be able to proceed a considerable distance up the River Seine. We hope to give more complete details later, the ships being nearly ready for their transatlantic journey.

AN EXTRAORDINARY ITALIAN ORDER

According to an extract from "Commerce Reports," published in the U. S. A. Official Bulletin for July, "the sending to foreign countries of any periodical or printed matter whatsoever containing advertisements is prohibited by the Italian Government. Directors and editors of Italian newspapers and periodicals and editors of Italian publications who intend to continue sending to foreign countries must prepare special editions in which the advertisements are suppressed.

"The periodicals and publications to be sent abroad must be submitted at the offices of the respective editors to the examination of a censor and of a postal official, to whom are consigned the copies certified for forwarding. Private persons are forbidden to send to foreign countries copies of newspapers, periodicals, and other publications containing advertisements."

This ruling seems most extraordinary, and certainly means the death knell to the future export business of Italy unless repealed. In these difficult times when the engineering works of all the Allies are overwhelmed with war work for their respective countries, and are out of contact with ordinary trade circles, it is vitally important for them to run a world-wide publicity campaign in order to keep their name constantly in mind. Then after the war, it will be much easier to renew their normal businesses.

AUSTRALIA'S THIRD AMERICAN-BUILT MOTORSHIP LAUNCHED

The launching of the third full-powered motorship built for the Australian Government by the Sloan Shipyards Corporation at Olympia, Wash., took place on the evening of July 3rd. She was christened the "Challamba." Two sister ships have already been launched; a description of the first one, the "Cethana," appears elsewhere in this issue; the second, the "Culburra," will have her official trials about the 25th of July. The fourth vessel, the "Coolcha," is practically ready for her launching, which may take place at any time now.

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Lubrication of Marine Heavy-Oil Engines

Details of the Leading Types of Lubricators

(Specially Written for "Motorship")

SOME little time ago the writer was shown a piston wrist-pin of about 4-inch diameter taken from the surface-ignition type oil-engine of a large auxiliary sailing-ship. It was worn absolutely to the shape of a half-moon, nearly two inches of metal having been literally "eaten" away on one side, indicating that there the engineers-in-charge must either have been completely devoid of intelligence and ordinary commonsense, or else were guilty of criminal negligence through not watching the lubricating system of the engine, or for running the engine with the pin so hot, unless it was in a storm. To get the wrist-pin in this condition the engine must have been kept running for hours with the wrist-pin practically red-hot.

While it is true that the engine in question was of the trunk-piston, enclosed-type, possibly making it somewhat harder to watch the lubricating system than in the case of an open-type crosshead engine, there must have been an obvious knock, also a certain amount of noticeable heat at the early stages of the trouble, which the veriest tyros could not have failed to observe had they "been-on-the-job" and paying reasonable attention to and interest in their duties. Had the engine been stopped when heat first developed at the wrist-pin, and the defect in lubrication adjusted, doubtless no damage would have been done. As it was, the owner of the ship probably put down the trouble to "unreliable oil-engine power."

However, what one really may marvel over is, how on earth the engine managed to keep running long enough to wear away such a large quantity of steel. No blame under the circumstances is due to the internal-combustion-motor principle, the responsibility being almost entirely with the human part of the men in charge, for it is not possible to make the operation of any propelling engine genuinely fool-proof. although, of course, the lubricating systems of some engines are far better arranged than others, and more reliable in consequence. The human element can only be met by well-warning the engineers previous to placing them in the ship and by giving them every encouragement to take interest in the machinery under their care.

In one case that came to our attention, not only did the motor give a lot of trouble, but some of the engineers left the ship after a single voyage. The owners put this down entirely to the engineers. But we happened to discuss the matter with one of the men who had stuck to the job and who was doing his best with the "scratch"-staff of assistant engineers. This man said: "the owners think it is the motors that cause we engineers to leave, but its the rotten food we are getting, due to a grafting skipper and about which the owners know nothing." We asked why they did not complain to the owners, but that would "put them in bad" with other captains, was their response. Consequently, while they were on the ship, they took no interest in the oil-engines, and quit the job as soon as a better opportunity offered itself. This shows that the surroundings and conditions under which the men work should be made as congenial as possible. Give the men good food, comfortable quarters and fair wages, and they will take sufficient interest in the oil-engines to see that the lubricating systems are maintained in proper working-order.

No matter how otherwise well-designed and constructed an oil-engine may be, it will not give proper reliability if its lubricating arrangements are not capable of adopting themselves to the severe conditions of maritime work. Furthermore, the lubricating system, with its mechanical devices, must concord to a considerable extent with the ideas of average ships'-engineers, otherwise it is as good as condemned, as they will take care to see that it is not given a fair chance. And no engine, or lubricator, designer can fully meet their requirements unless he spends a certain amount of time aboard ships studying the methods and view-point of engineers, thus becoming in a position to design his engine and lubricator systems more in line with those who will have to operate the engines at sea. Shipowners who are purchasing engines can bear this in mind and thus save themselves from being saddled with an engine or lubricator unsuitable for mercantile marine work.

It is of little use telling the ship's engineers that, "this engine has the ideal system and that it should be handled in such a manner," because engineers have their own ideas on these matters and will do as they please, particularly as they are more or less responsible. And, should anything ultimately go wrong the engineers often will contrive to saddle the fault upon the builder of the engine, knowing that many owners are likely to believe them, due to their still being more or less suspicious of the reliability of the oil-engine. Also the less work the engineers have in caring for adjusting, repairing and operating the lubricating system, the more it will appeal to them, and they will be particularly severe with an arrangement that gives them a lot of hard work, especially when they are in port and are anxious for shore leave.

Under the circumstances it hardly is wise for designers to introduce fancy designs and devices, but to make the entire engine with its lubricating fittings as accessible and simple as possible. This is one of the real secrets of successful operation of oil engines in merchant marine service. It is similar to an actor "playing to the gods."

Lubrication under pressure for all parts now is almost universally adopted with marine oil-engines, and this method of lubrication requires an enclosed engine, which does not limit the supply of oil used, and when necessary large flows of fluid to working parts can be made without much waste, because it is not splashed about the engine-room floor.

At the same time, an entirely enclosed engine rarely meets favor with marine engineers, particularly old steam men. Their methods are deeply ingrained and it is not easy for them to change even if they really endeavor to. Usually they follow the easiest line of resistance and stick to their former ways. This the designer must recognize. Let also the builder remember that the engineers are used to the open class of engine, with which it is easy to see the principal parts of the machine and to feel around at intervals in order to insure there is no increase of temperature in the bearings, etc., when the engine is in motion.

Richardson-Phenix Lubricating Oil-Filter System Aboard a Fairbanks-Morse Engined Cannery Tender

This enables the operators to know exactly how the engine is running, without any manual effort on their part. If they have to stop the engine, take off the little doors, and almost "climb inside" to feel the bearings, they naturally feel inclined to kick, as they feel that they are being given extra labor that really is unnecessary and would have been avoided had the designer and builder studied the engine-room work and conditions of operation.

Otherwise, these little things, which are cumulative, sooner or later will reflect upon the builder, who then lose further orders because of the reports of unsatisfactory working regularly emanating from the ship.

On the other hand, an open engine with gravity lubrication to the main bearings has shown to be far from completely satisfactory for merchant motorship work. It is different with a steamship where it always is hot in the engine-room due to the heat from the stokehold and boilers. The engine-room of a motorship comparatively is cool, and its temperature changes with the outside atmospheric temperature, be the changes ever so slight.

Consequently, if sight-feed gravity lubrication is fitted to a Diesel engine a change in wind often will stop the flow of oil that only a couple of hours before was set to run at the desired amount. Or the reverse to this may happen, and valuable oil will be wasted over the engine-room floor. This means careful watching and constant adjusting by the engineers, who feel the reverse to blessing and praising the gravity feed because of the work involved.

In order to effect good, reliable lubrication, and at the same time get into the good graces of the operating engineers, and thus ensure that they will be pleased with the engine and consequently attend it well, it may be best for the designer to adopt pressure lubrication throughout, and to have an engine entirely open from the lower parts of the cylinders to the bed-plates, but to enclose the oil with oil-tight sheet-steel plates that are easily detachable. Then the engineers, if they have doubt of early stages of hot bearings, can in a few seconds, have everything exposed to view and touch. In the minds of some engineers cast-iron box-frames and "large" doors only half-way meet this requirement. Other engineers claim that there are other advantages with box-frames that offset the benefits of an open engine. On another page in this issue Dr. Lucke thoroughly discusses this particular question of design.

Under most running conditions, there will be no necessity to detach the enclosing plates, or doors, of an engine because it needs but little manual effort for the engineers to make a proper inspection of inside casings before starting on a voyage. They then can make sure that all the oil pipes and ducts are clear and that all are in position. For, sometimes, they are moved out of position during overhauling when in port. Provided the filtering system is good and the oil-pumps or lubricators are in good order, the engineers can set their minds at rest about any fear of overheating of bearings and guide-blocks, especially if they know that it only takes a few minutes to have every working part completely exposed to touch and sight.

Here the advice of an old motorship engineer may be repeated—"Engine builders always should secure the lubricating feed-pipes inside the casings in a permanent position, so that it would not be necessary to take them down when overhauling. This would greatly lessen the work of the men. Some pipes often are bent to all sorts of shapes to get clearance inside the castings, and these try the engineers' patience and temper to get them re-adjusted again if they have gotten out of position. Furthermore, lubricating oil-pipes always should be of ample bore. If the bore of the pipes are small and if the oil gets a little thick, which it occasionally does after being in circulation for some time, the oil will not flow freely enough through the pipes, particularly in cold weather. With large bore pipes cleaning, too, is much easier, as they can be blown clear of debris with compressed air."

It does not pay to curtail the supply of oil to the chief working parts such as the crossheads, crank-pins, and main bearings; but the air-compressors must receive extra cautious lubrication as excess of oil may be carried to the air tanks and cause an explosion. Usually the high-stage receives no oil at all, there generally being sufficient oil in the air after it has passed the first two stages, to lubricate the walls. For this reason the high-stage compressor should be in a position where the engineers-on-watch can feel the jackets with their hands as they pass by and so constantly denote the temperature, for a seizing of the H.P. compressor probably would do no small damage, in fact, has done serious damage in more than one early motorship.

One thing may be mentioned for the benefit of engineers who are new to the marine Diesel engine. That is, the main bearings always will run with a certain amount of warmth, or rather heat, and is inclined to make a steam operating-engineer doubtfully shake his head until he gets accustomed to it. Particularly is this the case with two-cycle type Diesel engines, and the bearings should be closely watched for increase of the normal temperature, the latter itself being quite allright if the flow of oil is constant, and the bearing pressure not greater than is consistent with proper design. Some experts affirm that seven hundred to eight hundred pounds per square-inch bearing pressure should not be exceeded unless there are good reasons for the same, and the nearer six hundred pounds the nicer will be the lubrication of a

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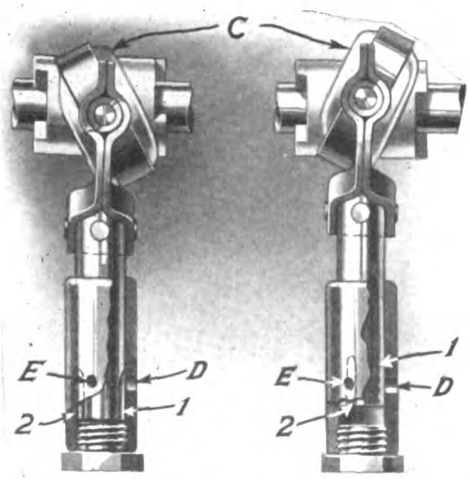


Figs. 1 and 2. Depicting Oscillating Motion of the Madison Kipp Lubricator

merchant ship engine, and hot bearings will be almost totally absent, except in instances of gross carelessness.

With a well-designed Diesel engine, if properly lubricated and operated, the wear of the main bearings can be kept down to one hundred and twenty-fifth part of an inch per twelve months' running. That is to say, as good as the finest marine steam practice, and better than the average marine steam engine.

One of the cardinal necessities in lubrication is that the oil should not be allowed to deteriorate. It diminishes in lubricating value by normal usage, as it is forced to the bearings, ejected and filtered, but this "natural" and inevitable deterioration is not of much moment if there are no special circumstances accentuating the rate of deterioration. There can be and often are such accentuating circumstances. In the first place where water (particularly sea water) is used as the cooling medium for the piston, which is the more common plan with large marine-motors (some use oil), it is not uncommon to find leakage taking place at some part of the system, in the knuckle-joints, swivels, telescopic pipes, or elsewhere, the result being that sometimes it drops down into the crank-sump, mixes with the oil, which is drawn from there, and very rapidly causes harmful effects in the bearings.

Consequently the design of the lubrication is interconnected with that of the cooling system, and that one of the incipient difficulties of the former is overcome if lubricating-oil is employed for cooling the piston-heads, as is the case in a fair number of four-cycle motors up to about 1,000 h.p. But, as is well known, the adoption of the oil-cooling system for the pistons necessitates special care in design to prevent the piston-head becoming

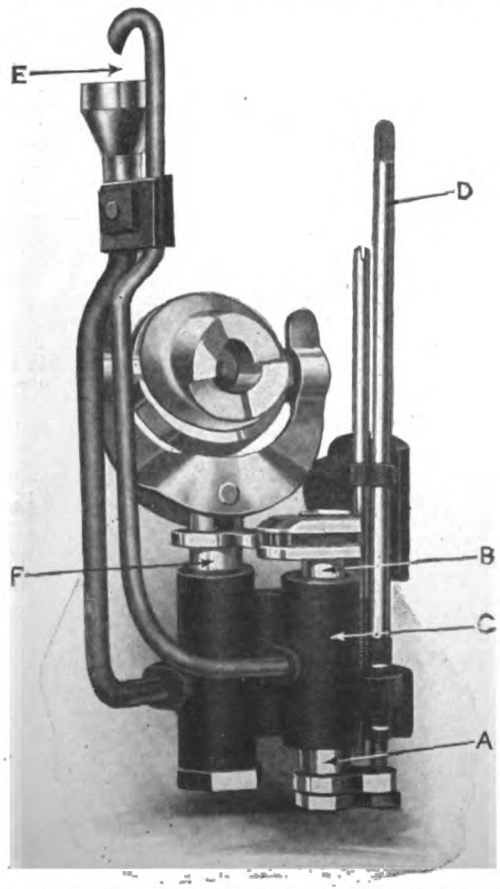


Fig. 3. Madison Kipp Pumping Unit with Measuring Plunger

thoroughly carbonized (as happened on a large Diesel motorship owned by the Atlantic Transport Company) when the cooling becomes defective and troubles are bound to arise.

Other troubles which are liable to arise from the use of lubricating-oil for piston-cooling have to be taken care of by the designer if oil be used for that purpose; but the same do not come within the scope of this article. Troubles arise, too, from inefficient cooling-systems, for the oil itself, or from absence of adequate oil-filters. Often, far too little attention has been given in the past to these features and one ship of which we know, had a 7-gallon filter but her engines used 15 to 20 gallons of lubricating oil per day.

Even if water is not used for piston cooling, or if a very tight and satisfactory water-cooling system is devised (and there are several excellent systems in use), there is another danger of pollution of the lubricating oil drawn from the crank-pit, namely, by the hard carbon deposit, resultant from the burned lubricating-oil from the cylinder walls, as well as the used oil itself, dropping down into the sump. It cannot always be properly filtered, but can be, and is, prevented in some engines by having a cover in the form of a metal tray at the bottom of the cylinder, through which the piston-rod can pass, but which otherwise encloses the cylinder. This will catch both the used cylinder-oil and any hard deposit, and the oil can be drawn off and separately filtered if worth while; but usually it is not desirable to use this small amount of oil again, at any rate in a machine such as an oil-engine, where lubrication is of first importance. This, of course, does not refer to the main-bearing oil, which, if protected from the carbon, can be filtered and used again.

Obviously, although main and crosshead bearing lubrication needs the greatest care, the most vital point in the system is the cylinder wall, and there is much to be said for completely isolating this section from the rest, and employing only new and unused oil for the purpose; this implies that the oil from the crank sump, which collects after passing through the other bearings and is filtered, should not be employed for cylinder lubrication, but only for the bearings. Opinions may differ on this point, as some engineers may consider it an unnecessary expense.

This method is now frequently adopted, and, as the quantity required for this particular purpose is not very large, it is not unlikely that it will ultimately become general. The arrangement of division into two systems is quite simple. For the cylinder walls there are the usual battery of small feed-pumps driven in any convenient manner, supplying three or four points on each cylinder, the supply being drawn from a small independent tank of new oil. For the bearings (shaft, connecting rod, etc.), similar lubricators can be utilized drawing direct from the oil filter into which the oil, which collects in the crank sump, is pumped by a small separate oil-pump. Recently it has been shown that the same quality of oil will do for both cylinders and bearings, which, of course, is a different matter to clean oil for the cylinders.

There are still a number of types of marine-oil engines in which no attempt has been made to separate cylinder wall lubrication from that of the bearings, and in which the oil used in the cylinders is allowed to drop directly in the sump in the crank-chamber, whilst in others, as we already have mentioned, as a concession to those who desire that the marine Diesel engine should resemble a steam-engine as much as possible, gravity feed is employed to many of the chief bearings. Before definitely deciding on the adoption of any particular system as a standard part of the engine, manufacturers would do well to make a close investigation of the causes of the known failures in Diesel motors due to defects in lubrication. Under ordinary maritime conditions, there are many excellent examples of standardized lubricators, and the best may as well be used.

How many owners and their engineers give deep study to the science of lubricating-oils, and how many owners let their ship's engineers purchase whatever class of oil is available at ports of call, instead of carrying several hundred barrels of properly selected lubricating oil from the home port and sending each ship to sea with a sufficient supply for the return voyage, and a little for reserve?

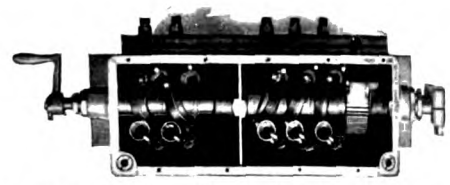
The subject of lubricating oils cannot be too carefully gone into. A suitable oil does not necessarily mean an expensive oil. In fact, some of the lower-priced oils have been used with great success on large motorships—oils of a grade the average shipowner would hesitate to use for steam engines. The main thing is all-round suitability!

Nearly all the large oil companies have a department for studying various classes of internal-combustion-engines and suitable lubricating-oils, and their services or advice at all times are at the disposal of shipowners. It pays to utilize their experiences!

Some engineers advocate the use of compound oils for lubrication of oil-engines, others raise objections, so a great deal of diversity of opinion still exists on that point. Viscosity of the oil is of more importance than flash-point and specific gravity. In connection with this some useful remarks recently were made by Mr. D. H. Conradson before the Society of Testing Materials.

"While the determiantion of viscosity—that is, body or consistency at a given temperature—is one of the vital tests usually applied to lubricating oil for internal-combustion engines, it is of importance only when the user of the oil is thoroughly familiar with the characteristics of the different crude oils of which it is made, and is sure that the mechanical condition calls for the use of an oil having the stated viscosity. Two oils of the same viscosity, made from different crudes, may behave quite differently under identical working conditions."

"The determination of viscosity of an oil, to be of the greatest value, should be made not only at the lower temperatures, but also as near its using temperature as consistent. On the one hand, an



Plan View of Madison Kipp Lubricator, Showing Double Compartment

oil of low viscosity might be preferable, since it absorbs less power than a thicker oil in the separation of metallic surfaces moving at a high velocity over each other; in other words, high viscosity means a high internal friction. On the other hand, if the oil is too thin it is more easily displaced from between the bearing surfaces, and a heavier oil might then be preferable, as the engine will be more flexible at low speed, owing to better seal and less leakage. Therefore, due consideration must be given to the influence of temperature on the viscosity, and to the necessity of selecting just the proper grade for the service required.

"Owing to the comparatively high temperature under service conditions, there generally is no trouble from the oil being too thick when once in

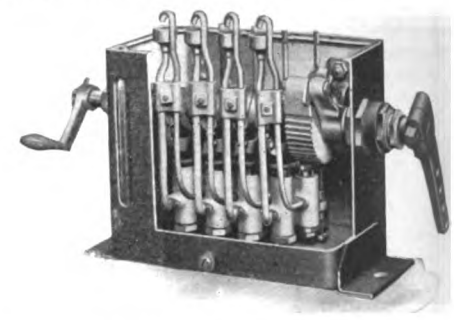


Fig. 4. Internal View of Complete Madison Kipp Lubricator

use. However, an oil must possess a degree of fluidity at ordinary temperatures—which are influenced by climatic conditions—suited to the method of supplying the oil to the working parts, so as to obtain proper lubrication at the start. A lubricating system with exposed pipes, especially a force feed system, should have a lower "cold-test" oil to meet these conditions; while in a system where the oil is carried in a pump integral with the engine crank case, and where the supply pipes are not exposed, all parts of the system quickly become sufficiently heated to promote a positive circulation and an oil with a higher "cold-test" may be used with good results."

As yet we have made no mention of the need for ample design of bearing surfaces, which is, of course, taken as axiomatic. One or two breakdowns have been caused by this being insufficient, but such mistakes are scarcely likely to be repeated, except, perhaps, in the high-power, two-cycle, double-acting type of machine if it is ever developed on a large scale, and, or which the problems are more or less unknown. In the case of large motors, indeed, several new conditions may arise which will need careful consideration, as exemplified in the case of a 1,200 b.h.p., two-cycle, single-cylinder, double-acting engine which was built, and which it was found impossible to run for more than a short period without the crosshead-bearing giving out—a difficulty which was only overcome by supplying this bearing with lubricating-oil at a pressure of something like 250 lbs. per square inch.

We may mention that because of the enormous demands made by Europe for war purposes, and because of the greatly increased domestic demand due to the tremendous quantity now required by the machinery of the hundreds of engineering

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works, munition shops, gun factories, motorworks, all of which are using ten times the previous amount of lubricants owing to large extensions and double shifts, there is likely to be a shortage of good lubricating oils soon, the present demand almost exceeding the supply. Therefore, it behooves all engine builders to make sure that they have on their motors an economical and efficient type of mechanical lubricator, and not "put their trust" in the "hand-squirt-cans" of ships' engine-room crews.

It has come to our knowledge that Germany has been having difficulty in obtaining good mineral lubricating-oil, which has caused considerable trouble among her submarine complements. They were using fish-oils, animal-oils, and, it is said, oils made from the bodies of dead soldiers; but the latter we hardly can credit, although anything seems probable with the Prussians in these days. Anyhow, it is reported that the use of non-mineral lubricating-oil in the U-boats for lubricating their high-speed Diesel-engines, has caused considerable sickness among the engineers and crews, due to the unpleasant odors which are not easily ventilated, especially if the submarines have to submerge quickly while their engines are still hot. However, we presume that Germany now must be getting good lubricating-oil from Russia.

Some builders of marine oil-engines adopt a large pump for the purpose of supplying oil under

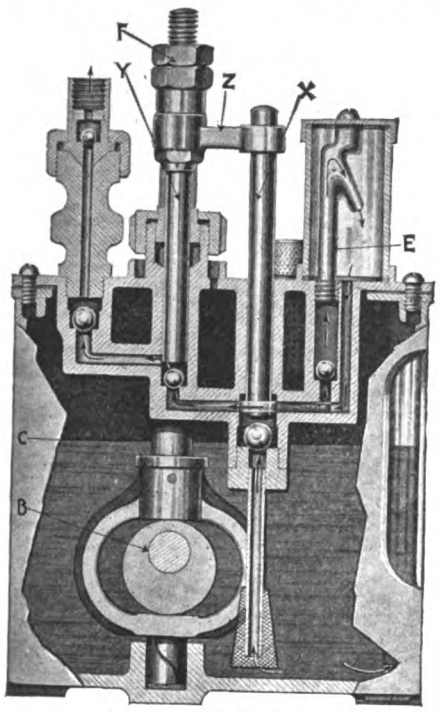


Fig. 6. Section of McCord Lubricator

pressure to all the moving parts; others adopt a large pump for the main-bearings and a lubricator of their own design, a standard make for the cylinders, compressors, crosshead-guides, etc. But most builders wisely utilize some standard form of lubricator for all working parts. A number of American concerns have specialized in lubricators (or "oilers," as they sometimes are termed) and by dint of careful study of methods of lubrication, and of the lubricating-oils themselves, have produced excellent devices. Consequently, American lubricators have been adopted by marine oil-engine builders all over the world, including for submarine engines of the principal navies. Therefore, a description of some of the leading designs and makes will be of considerable interest.

The Madison-Kipp Lubricator

The lubricators built by the Madison-Kipp Lubricator Co. of Madison, Wis., are of one standard design, but with provision for different services. For instance, there are the sight-feed and the blind-feed types. The sight-feed is built with a visible feed and an individual fine adjustment for each unit. The blind-feed is designed for service where fine adjustment and visible feed are not necessary. It can be adjusted, however, by means of employing different radii on the ratchet arm. Otherwise, the sight-feed system is employed.

The special features of the Madison-Kipp design is the method of pumping and forcing the oil without the use of ball and spring valves, the idea being that there are no valve-seats for slight particles of foreign matter to lodge upon and so cause improper operation. Its valveless action is accomplished by a double-eccentric that imparts not only a reciprocating but an oscillating motion to the plunger. The oscillation motion is affected by the position of the plane of the eccentric as shown by (C) in Figs 1 and 2, the plane being at an angle of 27 degrees to the actuating-shaft. Into the eccentric, at the 27 degree plane, is fitted a ring which the eccentric element raises and lowers, and so the angle of the plane imparts an oscillating motion to the plane itself. (C) of Fig. 1 illustrates the eccentric in a position after it has been rotated one-half-turn past position (C) of Fig. 2.

By looking at the lower part of Figs. 1 and 2, the pumping principle can be understood, the intake port being at (D), and the discharge port being at (E). In Fig. 1, the plunger is in a position to draw a supply of oil through a groove (1) which then is in register with intake-part (D). As the plunger or piston is raised, oil is drawn into the barrel of the pump. Turning again to Fig. 2, it will be seen that the plunger has been raised and oscillated at the top of the stroke, and is in a position to descend again and discharge the oil from the barrel through the discharge port (E), and by this time the groove (1) has turned away from the intake port (D) with the result of the latter being sealed. There is another groove (2), however, which simultaneously has turned to register with the discharge port (E) thus opening it. While eccentric motions are not always easy to understand in print, it is not difficult to see that at the end of the down-stroke, the plunger will again be oscillated back to its original position in Fig. 3.

A number of these eccentric pumping units are contained in a steel box, or oil-retainer, each part of the engine to be lubricated having its own unit-feeder and measuring sight-feed plunger. All are driven off a single shaft, which carries the eccentrics, and which shaft is driven by a ratchet-wheel that is fitted with a bushing engaging directly with clutch-jaws in the eccentric. Each eccentric has clutch-jaws which engage with the eccentric immediately next it on the shaft. Therefore, the driving power is transmitted through the eccentrics, and not through the shaft. All ports run in an oil-bath, because, as previously mentioned, the steel container is full of oil. In cases where two kinds of lubricating-oil are desired, the container is divided into two compartments, as shown in the plan view. The Fig. 3 illustrates a complete pumping unit with its measuring plunger.

By referring to Fig. 3, it will be seen that the eccentric principle is made to serve the purpose of operating two plungers; a delivery plunger and a sight-feed measuring plunger. The hollow sight-feed plunger "B" is operated from the plunger "F" by means of gears. A steel sleeve "A" is inserted between the hollow measuring plunger "B" and its barrel "C" to provide means for regulating the amount of oil that is passed through the sight-feed tube arrangement "E" to the delivery plunger. The sleeve is adjustable up and down by means of spindle "D," and its position times the registration of a combination of ports in the hollow plunger, sleeve and barrel, thereby measuring the portion of oil for the sight-feed and the portion to be bypassed back into the tank. The amount of oil which is passed through the sight-feed is received by the delivery plunger and forced to its proper destination.

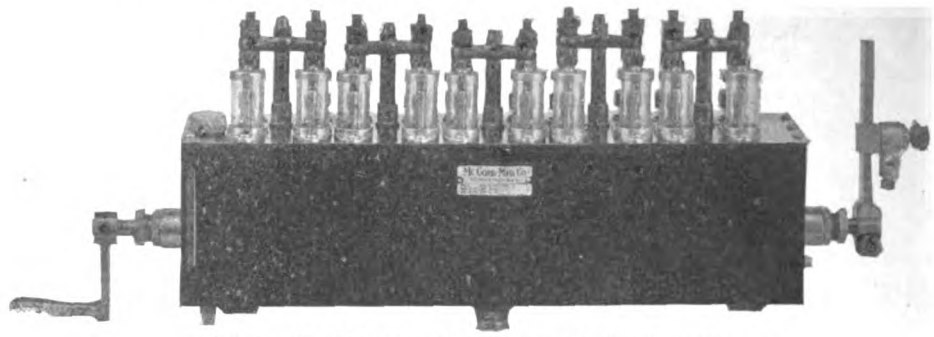


Fig. 5. The McCord 10-Feed Force-Feed Lubricator

The McCord Lubricator

Perhaps one of the greatest compliments ever paid to American lubricator design by foreign Diesel engine builders, was the adoption of the McCord lubricator for some of the latest submarine Diesel engines of the Italian Royal Navy, and it may be remembered that the lubrication-oil consumption of the Tosi 1500 b.h.p submarine Diesel engines on extensive tests was 8 grammes (0.0180 lb.) per b.h.p. hour. What proper lubrication means to internal-combustion-engines is thoroughly established by the tests in question which were of 145 hours (six days and nights) continuous, of which 36 hours were at 300 R.P.M. and 96 hours at 260 R.P.M. Not only is this a severe test for the engine; but, it is strenuous work for the lubricating system, also for the oil, because the best of lubricators will not produce satisfactory results with an unsuitable oil. The entire combination must be of a co-operative nature.

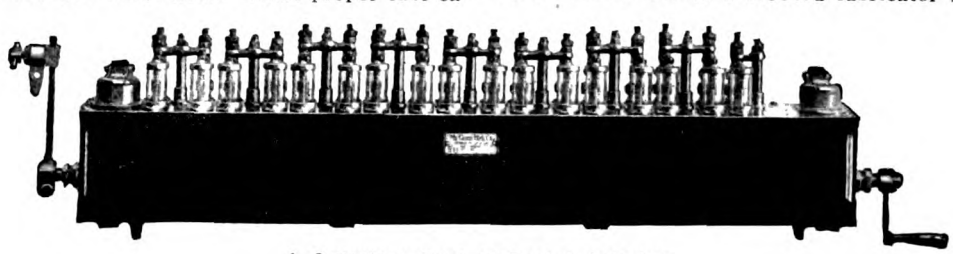
The McCord lubricators for these engines, Fig. 5, were designed and constructed by the McCord Manufacturing Company of Detroit, Mich. There are three lubricators installed on each of these engines, and each containes a number of pumps. Each pump unit in turn consists of a cast body hung from the top of a reservoir containing two pump plungers, which are connected at the top by a "crosshead" and actuated vertically by another "crosshead" attached to the stroke-shaft, the latter being worked by an eccentric that is rotated by a ratchet-mechanism off the engine.

In operation the primary plunger on its upward stroke draws the oil from the reservoir and on its return stroke delivers the oil through a sight-feed whence it is drawn by another plunger that is on its upward stroke and so is forced under pressure by the downward stroke of the same to the part of the engine to be lubricated. The amount of oil to be delivered by each feed is determined by means of adjusting nuts which are hand regulated. On the engine itself are mounted strainers and coolers so as to assure of a clean and cool oil supply.

This mechanism, perhaps, can best be followed by referring to Fig. 6. The two pump-plungers contained in the cast body that is hung from the top of the reservoir are marked "x" and "y" and they are connected at the top by a crosshead "z", and actuated vertically by another crosshead attached to the stroke-shaft "C," which in turn is driven by the eccentric "B." As just stated, this ecentric is revolved by a ratchet mechanism located at one end of the interior of the reservoir and driven by a shaft extending through a stuffing box to the exterior. The primary plunger "X" on its upward stroke draws the oil through the intake and delivers it to the sight-feed "E," whence it is drawn by the delivery plunger "Y" on its upward stroke and forced to the point to be lubricated by the downward stroke of same. The amount of oil delivered by each plunger is entirely dependent on the length of stroke which is regulated by the adjusting nuts "F," shown just above the driving yoke "Z." The lower these adjusting nuts are set, the longer the stroke of the plungers, and consequently, a greater delivery of oil results.

From this description it will be understood that this lubricator has simple sight-feeds which enable the engineer to see how much oil is being pumped to each cylinder or part to be lubricated and the exact quantity per stroke of the plunger. The amount can be regulated from one drop to a full stream per stroke. Another feature is that each unit has independent adjustment, and can be removed from the reservoir without disturbing the set regulations of the other pumps or removing the reservoir from the engine base. The adjustment is easily made by means of thumb nuts on top of the delivery plunger. A gauge glass in the reservoir shows the oil level. All working parts are made of drop forged steel, case hardened, constantly running in oil, so that the wear on the lubricator itself is reduced to a minimum.

Every pump is tested against 1,000 pounds pressure. There also is a McCord lubricator for use



A Seventeen-Feed McCord Lubricator

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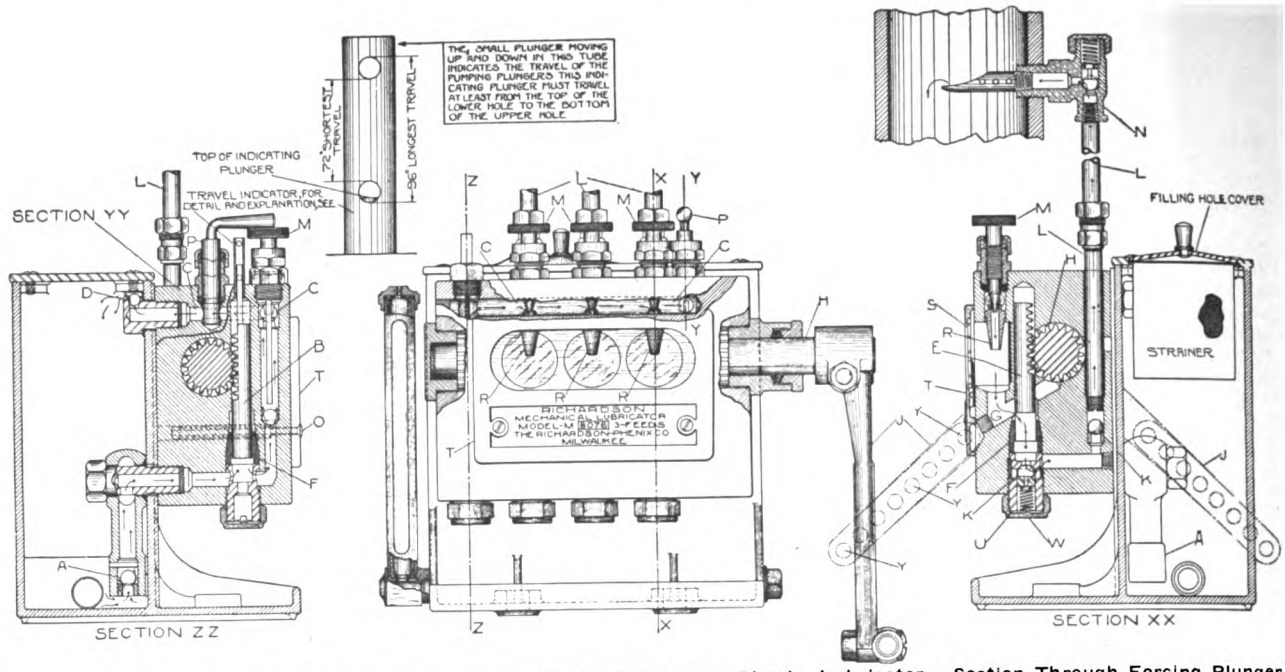

THE SMALL PLUNGER MOVING UP AND DOWN IN THIS TUBE INDICATES THE TRAVEL OF THE PUMPING PLUNGERS THIS INDICATING PLUNGER MUST TRAVEL AT LEAST FROM THE TOP OF THE LOWER HOLE TO THE BOTTOM OF THE UPPER HOLE
TOP OF INDICATING PLUNGER
72" SHORTEST TRAVEL
96" LONGEST TRAVEL
TRAVEL INDICATOR FOR DETAIL AND EXPLANATION SEE
SECTION YY
SECTION ZZ
RICHARDSON MECHANICAL LUBRICATOR MODEL-M 3 FEEDS THE RICHARDSON-PHENIX CO MILWAUKEE
FILLING HOLE COVER
STRAINER
SECTION XX

Section Through Circulating Plunger B — Fig. 7. Section of Richardson Phenix Lubricator — Section Through Forcing Plunger E

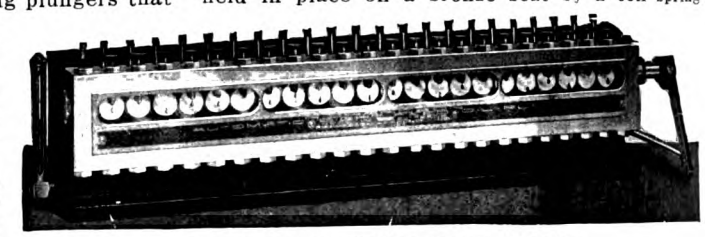
with marine gasolene engines where delivery of the oil against such high pressures is not required, and where compactness is a great asset. This model has the characteristic features of the other lubricator, namely, two pump plungers for each feed, a constant drop sight-feed showing the exact amount of oil for each feed and a simple but accurate outside adjustment for each feed independently. But, unlike other McCord lubricators, the pumps are arranged in groups, operating in one base or body, but all parts are readily accessible. The reservoirs are of polished brass, but sometimes are made of sheet steel or cast iron, black enameled. The driving mechanism may be rotary or ratchet and it should be noted that ratchet drives may be located only at either end of the reservoirs. The rotary drive may be located in any one of many positions and rotates in either direction.

The Richardson Lubricator

The Richardson lubricator is particularly adapted for slow-speed, heavy-duty motors, such as large merchant marine Diesel-type engines. For such machinery as the latter, where the timing of the oil feed is an essential feature, the model M is the most suitable of the lubricators made by the Richardson-Phenix Co. of Milwaukee, Wis. It is claimed by the makers that it is the only lubricator now on the market in which the pumping plungers that feed the oil to the working parts can be synchronized with the pistons of the engines, which enables an introduction of a small drop of oil at each stroke-cycle in accordance with the position of the engine-piston.

The operation of this model is seen in Fig. 7, the travel of the oil being denoted by arrows. Fig. 8 shows the construction of the lubricator body and corresponds to section XX in Fig. 7. Referring to section ZZ, the oil is withdrawn from the reservoir through foot valve "A," by means of plunger "B," which delivers the oil through the circulating gallery "C" running across the entire width of the lubricator and into which the drip nozles "R" open. The amount of oil flowing through each drip nozzle "R" depends upon the setting of its needle valve "M"

The surplus oil not passed through feed nozzles "R" returns to the reservoir, though the overflow ball-check "D." The slight gravity head on each drip nozzle is constant so that the oil flows drop by drop at any desired rate into the chamber "G" plungers "E" for each individual feed line are actuated by the driving lever "J" through a common gear shaft "H." These plungers move up and down with every revolution of the engine and at each downward stroke chop off a small particle of the oil lying in the chamber "G" and force it out through the check valves "KK" and on into the feed lines "L" past the terminal check valve "N" and on to the point of delivery. The babbitted bushing "F" can be quickly taken up for wear by removing the hexagon cap nut "W" and slightly tightening up the valve-cage "U." The feed lines are always full of oil up to the check-valve "N" located at the point of delivery; thus, every time the pump plungers come down they force a small particle of oil into the oil line, liberating a corresponding amount at the terminal check-valve. As the oil is forced through two check-valves "KK" and a terminal check-valve "N," there is no liability of pressure backing up into the lubricator. The check-valves are of a special steel ball type, held in place on a bronze seat by a coil spring under a hexagon nut. The lower end of the tube "L" is slotted so that the ball in the rear check-valve "K" cannot seat on the end of the pipe.



Twenty-two Feed Richardson Lubricator

A very important feature is the increased feed valve "P" located at the overflow end of the oil circulating channel "C." This valve is normally left open, but it can be closed should there be a temporary demand for more oil, thus shutting off the return to the reservoir and building up a pressure in the channel "C" causing an increase in the rate of flow through the nozzles "RR." When the increased demand has been met, the increased feed-valve "P" is opened. Thus the adjustment of the needle-valves "M" need never be changed to meet a temporary demand for additional oil.

The driving lever "J" requires a reciprocating movement of from 72° to 96° and can be moved to any position radially on the shaft. The necessary travel of the lever "J" can be adjusted by attaching the driving rod pin in any one of the eight wist-pin holes, thus permitting any straight across travel from 3½ to 10 inches.

The proper travel of the oil pumping-plungers is shown by the travel indicator on top of the lubricator. The shortest travel must not be less than from the top of the lower hole to the bottom of the top hole. The longest travel must not be more than from the bottom of the lower hole to the top of the upper hole. The name plate "T" is

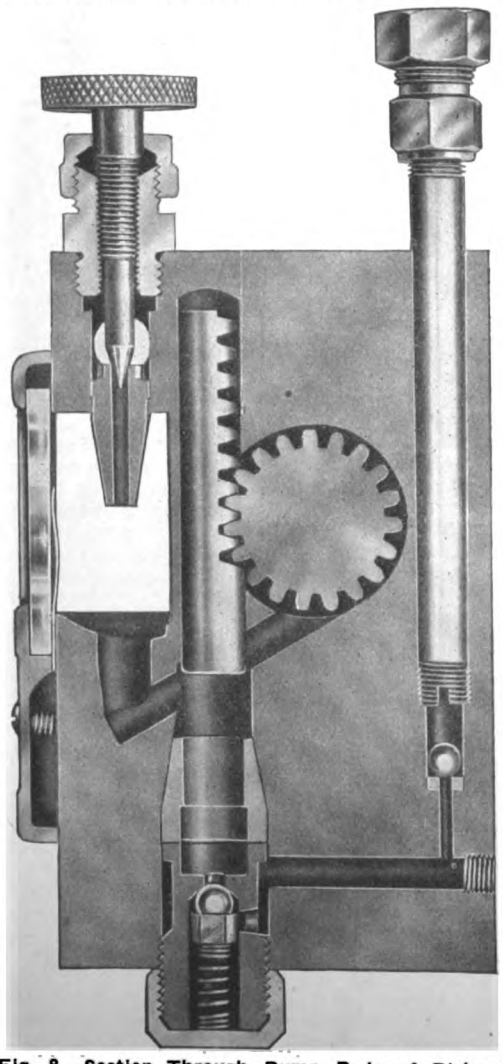


Fig. 8. Section Through Pump Body of Richardson Lubricator. This Section Corresponds to Section XX Fig. 8

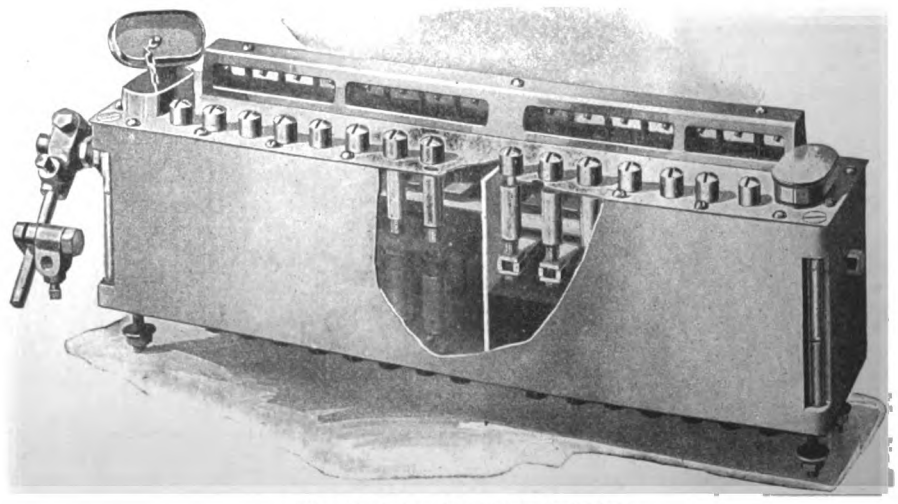


Fig. 9. The Manzel Lubricator

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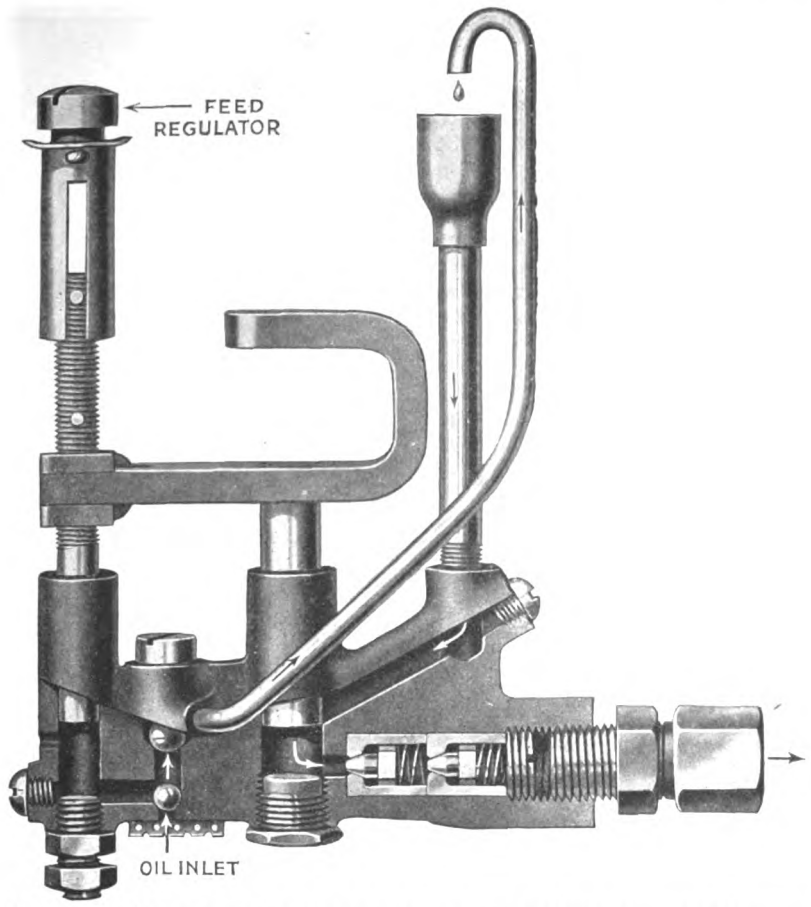

Complete Pumping Unit of the Manzel Lubricator Showing Travel of Oil and Feed Regulation

held in place by spring retained screws so that the top of the frame "T" can be tilted forward and the back of the glass wiped off.

The Manzel Lubricator

This lubricator (Fig. 9), perhaps, is better konwn among users and builders of gasolene marine motors than among large merchant type, heavy-oil engines. It is made by the Manzel Bros. Co. of Buffalo, N. Y. Some models are arranged to use two kinds of oil, namely a heavy and a light; which is a useful feature where one class of oil is required for the cylinders and a different grade for the bearings. For this purpose the oil-reservoir is divided into two compartments.

Manzel lubricators are built on the unit principle with an individual pumping unit for each cylinder to be lubricated. Each unit is in itself a small double plunger-pump. The smaller or primary plunger draws the oil from the bottom of the reservoir and forces it through the sight glass into the oil cup below. The oil is then drawn from the cup by the larger or secondary plunger and forced through the discharge valve to the engine cylinder.

Both plungers are of steel and are ground to exact size, and will pump up to 1000 lbs. pressure. Any one or more of the units may be removed from the reservoir without removing or interfering with the others. The entire working mechanism runs in an oil-bath.

For the purpose of simple description it may be said that the Manzel lubricator consists of a series of individual pumping units placed in a central tank or reservoir, one unit for each point to be lubricated. From each unit the oil is forced through a tube or pipe direct to the cylinder or bearing being lubricated by that unit. These units are operated by an eccentric which, in turn, is driven by a ratchet or rotary movement obtained by connecting to the cam shaft or some other moving part of the engine.

Every feed is regulated independently and can be adjusted to supply the exact amount of oil needed, and may be set to supply as little as one drop every one or two strokes of the plunger, or up to 15 or more drops with each stroke. The ratchet wheels are cut from solid bars of steel, drilled, milled and hardened.

The Detroit Force Feed Oiler

Last but not least, we come to the Detroit lubricator, which is constructed by the Detroit Lubricator Co. of Detroit, Mich. This equipment consists essentially of one or more pumping units—one unit to each feed—actuated by a driving shaft which is in turn driven from some moving part of the engine by a belt, chain, ratchet or gear. The entire mechanism is contained in the tank or reservoir. Each pumping unit is a double-plunger valveless pump. One plunger pumps the oil from the reservoir through the sight-feed nozzle, from which it drops in plain sight, and the other plunger takes the oil from the sight-feed chambers under the nozzle and forces it to the part to be lubricated.

By referring to the section illustration (Fig. 10) the operation may be easily understood. The upper piston "B," driven through the bell crank yoke "E" by the eccentric "C," lifts the oil from the reservoir and discharges it from the nozzle "N." The amount of oil discharged is regulated by the adjusting button on cover, this button having at its end the cam "A" which controls the throw of piston "B." The lower plunger "C" takes the oil from the pocket in the sight-feed chamber under the the nozzle "N" and forces it to the point to be lubricated through the tube "O." This forcing plunger "C" is driven by the eccentric "F" through the yoke "D."

The bell crank yoke "E" and the straight yoke "D" give to the pistons an alternate movement, each being substantially at rest while the other is passing through its 90 degrees of most rapid travel. A port in each piston controls the passages to the other so that each becomes without addit onal mechanism, a mechanically operated valve for the other.

The eccentric "C" is driven by the eccentric "F" and when the engine is working ahead is in the same position on the eccentric shaft. When the engine is reversed, however, the eccentric remains stationary until "F" has advanced 180 degrees in the opposite direction, when it is again picked up and driven in the new direction by "F" (See Fig. 10). By this simple method the passages, ports and plungers are made to automatically and instantly respond to a change in direction of the drive without adjustment of, or interruption to, the flow of oil.

As explained above the pistons for a unit (both sight-feed and discharge) more alternately, one being at rest while the other is in motion, and each in turn acts as a mechanically operated valve for the other, thus avoiding the necessity for a separate valve mechanism. No ball-checks or check-valves are employed. We have referred in the early section of this article to the change in flow of oil causd by the dropping or raising of the engine-room temperatures; in cases where gravity feed is used, but it is claimed by the makers that the Detroit lubricator is not effected by changes in temperature. This indicates, at least, one advantage of a pressure system.

With the Detroit ratchet the action of the pawls is quickened by the use of compression springs which are not fastened at the ends, but placed in grooves or pockets. The ratchet has thirty-three teeth and two pawls so arranged that a stroke equal to one-half a tooth may be obtained, if so short a stroke is desired. The two pawls engage alternately, each pawl picking up a tooth every other stroke, allowing a minimum stroke equal to one-half a tooth, or 1-66th of a revolution of the shaft. The odd number of teeth—thirty-three—brings the load on a different set of teeth every successive revolution, eliminating excessive wear on a few teeth.

In conclusion, let it be noted that "Motorship" will be glad to give editorial space to lubricator manufacturers, engine-builders, oil companies and ship's engineers, for the purpose of enabling them to outline their opinions regarding the different questions of the subject of lubrication raised in this article.

T. O. L.

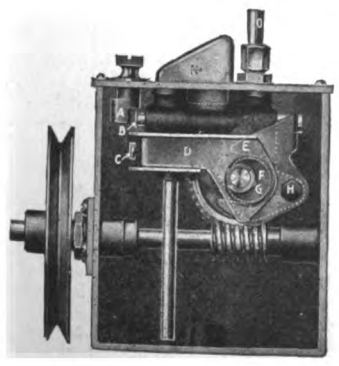

Fig. 10. Section View of Detroit Oiler

Fig. 11. Mechanism of Detroit Oiler

CRAMP'S NEW PRESIDENT

Mr. J. H. Harry Mull has been elected president of the Wm. Cramp & Son Ship & Engine Co. of Philadelphia in place of Mr. H. W. Hand, resigned. Cramps are the sole U. S. A. licensees of the Burmeister & Wain marine Diesel engine.

"RANA" A NEW SCANDINAVIAN COMPOSITE MOTORSHIP.

The Rederi A. B. Backerod of Uddevalla, has just taken delivery of the motorship "Rana," a vessel of 450 tons net register (about 800 tons dwc.) built by the A. B. Stromstads Mek. Verkstad. This ship is built of wood and iron and is driven by two 180 h. p. Original heavy-oil engines, giving a speed of 8 knots.

THE AMERICAN FORGE & STEEL CO.

We will be glad if any of our readers can give us the address of the American Forge & Steel Company of Philadelphia, Pa. They recently sent a subscription to the office, but our acknowledgement has been returned marked "not in directory" by the Philadelphia Post Office.

FRENCH SUBSIDIZE MOTORCRAFT

Subsidies are given on the hull and oil-engines of all commercial motorcraft built in France from August 1, 1916, up to three years after conclusion of the war. This subsidy also is given on hulls fitted with foreign oil-engines, so French oil-engine builders receive an additional subsidy. There is, however, a tax of $15.00 per ton on fuel for internal-combustion-engines, compared with 22 cents per ton on coal. As a solution of this problem, the French Congress voted that stocks of oil should be kept in bond at all ports for the use of ocean-going vessels and fishing craft fitted with internal-combustion motors, and also for use in the shipyards and other establishments making or repairing internal-combustion-motors.

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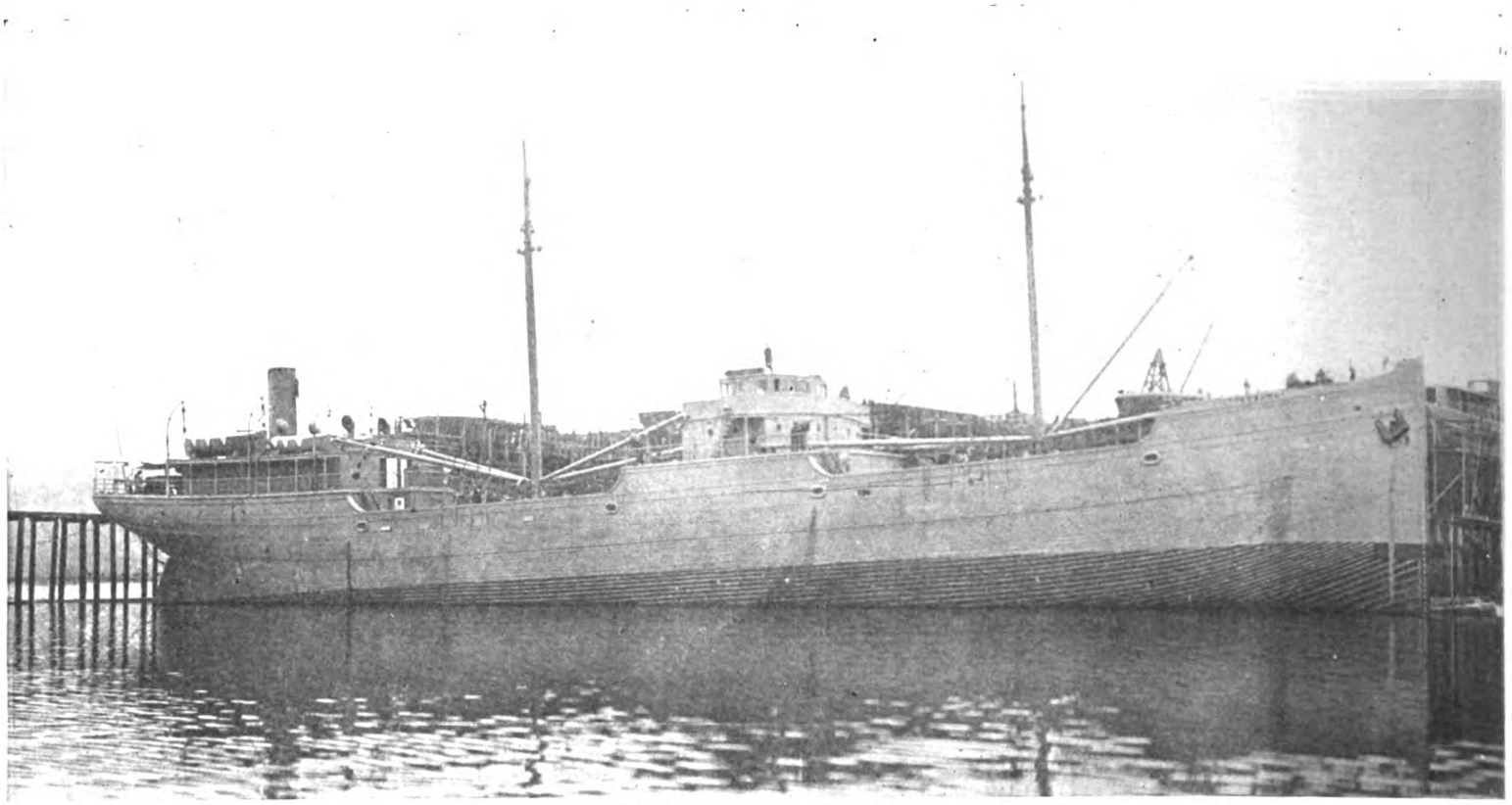


THE AMERICAN-BUILT AND ENGINED FULL-POWERED DIESEL-DRIVEN WOODEN MOTORSHIP "CETHANA," OWNED BY THE AUSTRALIAN GOVERNMENT

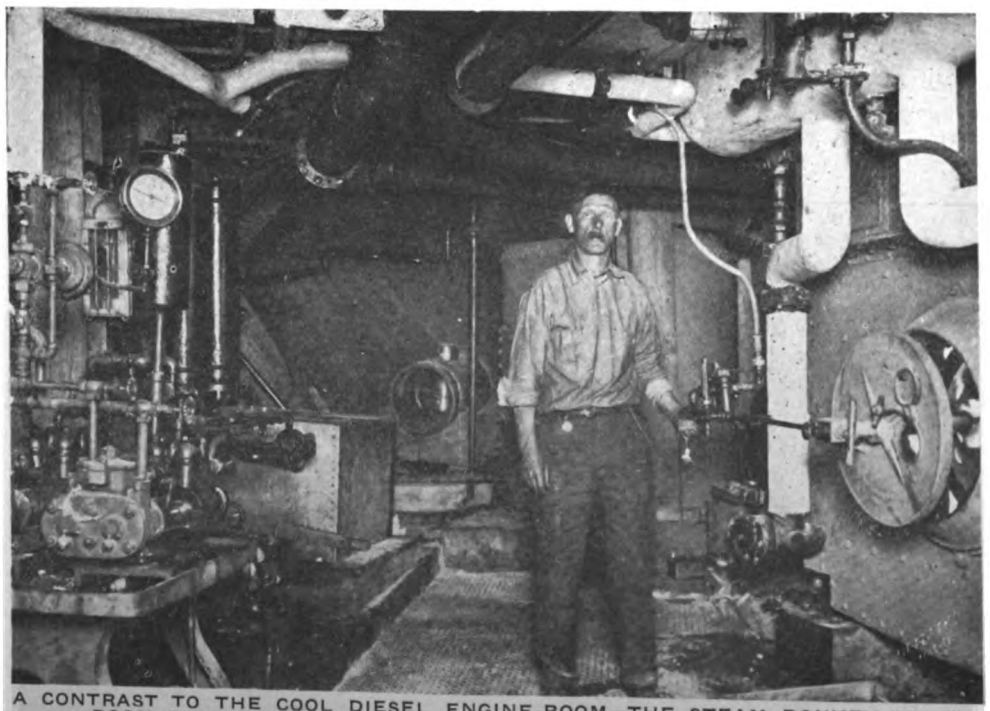
Trials of the Motorship "Cethana"

A 1000 B. H. P. Diesel-Driven Wooden Vessel of 3,200 Tons D. W. C. Built in a U. S. Government Operated Shipyard.

SOME Diesel engine builders in this country are opposed to having their engines installed in large wooden ships; but others have no serious objection provided they are well bedded, although they would prefer to see them installed in steel vessels. In view of the fact that very considerable hogging is taking place with some of the large wooden steamships recently constructed, the operation will be closely watched by this Government, naval architects, engineers, and owners alike, particularly in instances where the engines are installed amidships where the hogging is likely to have the greatest effect on the machinery. Fractured crankshafts and hot bearings are the main things to look for under such circumstances. To avoid such possibilities we are inclined to think that it would be advantageous to pour concrete round the engine bed until the whole forms a solid mass. Then the strains would first reveal themselves in the concrete, giving time to avoid damage to the engine.

Recently the trials took place of the first of the four largest full-powered wooden motorships yet to be constructed in the United States, and, as this ship will proceed to Australia for her maiden voyage, the results of the latter will be of the greatest importance to shipping men, especially as the conditions will form a very severe trial for the marine oil-engine.

The motorship "Cethana," which was launched from the yards of the Sloan Shipyards Corporation at Olympia, Wash., is an unusual one for many reasons. She is unusual because so far she is the first merchant vessel to be built under the direct supervision of United States Shipping Board officials. She was built in the only yard in the United States which is actually operated by the Shipping Board. Also she holds more than passing interest for everyone interested in the development of the marine oil-engine, for within her are installed the first pair, yet to be installed, of McIntosh & Seymour Diesel-type oil motors. She is a striking-looking vessel and was built from designs by Theodore Ferris of New York.



A CONTRAST TO THE COOL DIESEL ENGINE-ROOM—THE STEAM DONKEY-BOILER ROOM OF THE "CETHANA." THE AUXILIARIES ARE STEAM DRIVEN.

The "Cethana" and her sister ships, the "Culburra," the "Challamba," and the "Coolcha," are four motorvessels built at the above-named yards for the Commonwealth Government of Australia, and which are to be used in trading from Australia to the United States. The launching of the "Cethana" took place on February 23rd last.

On June 23rd, under the direction of officials of the Shipping Board and representatives of the Australian Government the trials of this first vessel were held over the regular mile course at Olympia, where she averaged 10.35 knots without in the least extending herself. A feature of her trials was her maneuvering. The engine was reversed from full ahead to full astern in 15 seconds when the engine-room crew totally unexpected the sudden order. From full astern to full ahead, with the engine-room staff on the lookout for the change, took 9 seconds. Everyone on the trials were delighted with the performance of the vessel and the working of her engines. A total lack of vibration was one of the noticeable features. Another matter was the quiet running of the engine when in operation.

To the following people a great deal of credit is due for the splendid showing of the "Cethana": Capt. McIntosh, Marine Superintendent; H. H. Sanderson, Supt. Engineer from Australia; H. M. C. P. Roderick, a Diesel engine expert loaned to the Australian Government by the British Admiralty, who has had very considerable experience with Diesel engines of submarines of the British Navy, and to A. A. Asplund, of the McIntosh & Seymour Corporation, who erected the engines. These men certainly have accomplished excellent work in the installation of the "Cethana's" engines.

On board the "Cethana," during the trials, were the following people: W. Pigott, representing the wooden ship program of the Shipping Board in the Seattle district; A. R. Hunt, Engineering Officer of the Shipping Board, and his assistant, Mr. Bell; L. E. Geary, Naval Architect for the Shipping Board; J. J. Lynn, an Eastern Superintendent of the Shipping Board, and Mr. Chevalier, Consulting Engineer from San Francisco, who made the tests for the Shipping Board.

The "Cethana" and her sister ships are wooden ships of very much the same type as the American barques trading to Australia having square transoms. They are each 280 feet long (Lloyds length 265 feet), have a breadth of 46 feet outside the planking, a moulded depth of 24 feet and a loaded draft of 22 feet, giving them a deadweight capacity for 3,200 tons. The remaining ships are also to be equipped with twin 500 b.h.p. six-cylinder, four-cycle type McIntosh & Seymour Diesel engine.

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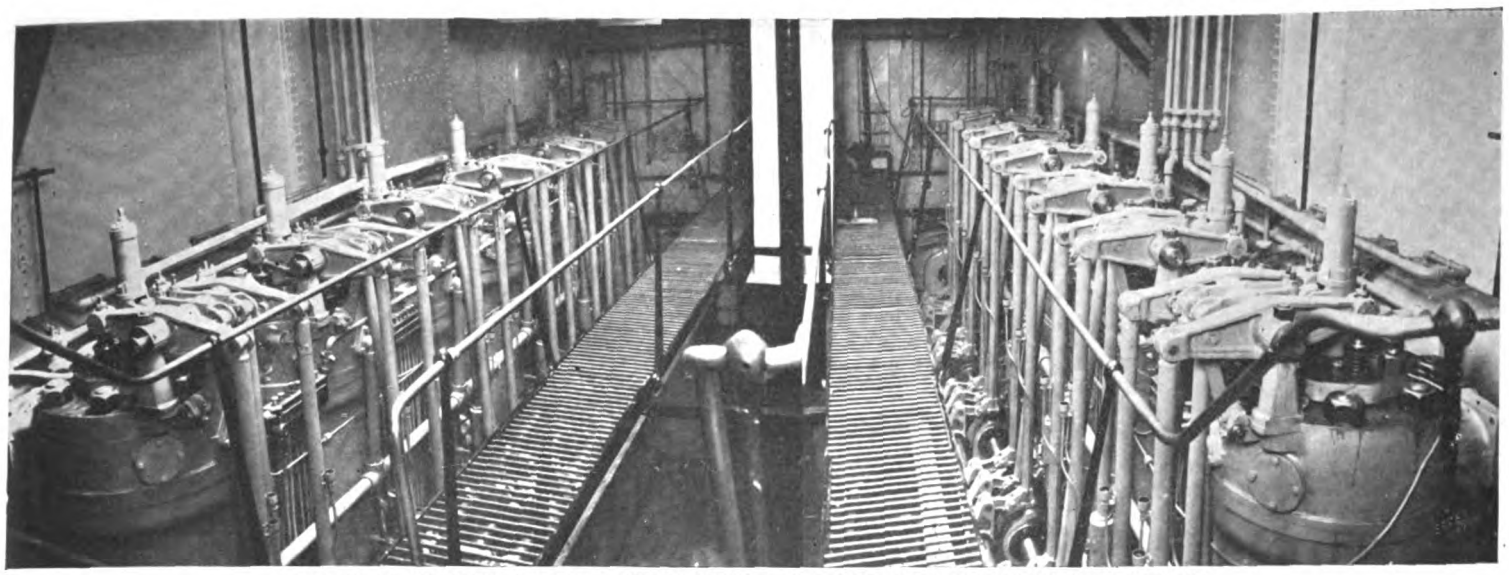


UPPER PLATFORM OF THE "CETHANA'S" ENGINE-ROOM SHOWING THE VALVE-OPERATING MECHANISM OF THE McINTOSH & SEYMOUR DIESEL ENGINES

On deck are steam winches of the fricti n type, two to each of the four hatches. The electric-lighting is generated from a 110-volt nine k. w. Engberger dynamo coupled to a single-cyl nder engine.

Acccording to Mr. Roderick, the engines are fool-proof, for, as he states, "it is impossible to move the reversing-wheel and mechanism while the engines are in rotation in either direction." Vibration, which has been the source of great annoyance with some Diesel and steam engines of the marine type, has been eliminated. The engines are direct-reversible, with the Richardson-Phenix force-feed lubrication to all the main working parts. The air compressor is of the three-stage type, compressing up to 1,500 lbs. to the sq. in. Each cylinder has an independent fuel pump, which can be operated 'o on or off position from the forward end of the ngine immediately over the reversing and control-ing mechanism.

On her trials held immediately after the installa-ion was completed the engines developed 512.7 . h. p. at 186 r. p. m., with a fuel consumption of .42 lbs. per b. h. p., with a mean-effective-pressure f 96.47 lbs. to the sq. in.; this gave the vessel a peed of 10.5 knots, although her hull was foul 'ith sea growth, having laid in the water so long. 'he fuel to be used and which was used on her fficial trials was Standard Oil "Calol" (Specific ravity .91 and caloric value of 19,000 B. T. U.'s. 'er lubricating oil was also of the heavy "Diesel ype," which was also supplied by the Standard il Company.

"Cethana" will, it is anticipated, depart on her aiden voyage about the 28th of July, after loading 0 tons of steel plate at Tacoma, 1,200 tons of aper at Powell River, Canada, and lumber at verett, Wn. After taking on fuel-oil at Everett, e will proceed to Australia via Honolulu.

The accommodations for the officers of these essels are of the very best, as are also those of e engine and deck crews. Each officer has a bin to himself, equipped with electric-light and n, a wash-hand basin and stand, a wardrobe, est of drawers located below the sleeping berth, settee, writing-desk and book shelf. Nickel-ated fittings are placed throughout. The Cap-in's cabin is equipped similarly to those of the other officers, but, in addition, has an escretaire writing-desk, and adjoining his cabin is a bath-room and toilet for his private use. In addition to the three officers' staterooms, which are located amidships, there are cabins equipped for the owner, purser and wireless operator, and bathrooms and toilets for the officers, with enamel bath, hot and cold water, steam fittings and a shower bath. The floors are of mosaic tiling.

The cabins for the engineers, four in number, are situated aft on the poop deck, close to the engine-room. They are equipped in every detail like those of the officers. A bathroom and toilet for the engineers is installed close to their quarters, for their convenience. The crew's quarters are located under the poop deck, in quarters equipped with iron bedsteads and spring mattresses, sanitary steel wardrobes, chest of drawers and wash-hand basins. They, too, have electric light. The cooks, mess-room stewards, three oilers and the donkeyman are located on the port side of the lower poop deck, and six sailors, three quarter-masters and the boatswain are placed on the starboard side. The crew have a very nicely fitted messroom, with a dumbwaiter to supply food directly from the galley.

Captain H. Binning will be in command of the "Cethana" on her maiden voyage. Capt. Binning, before coming to America to take charge, was engaged in the pilot service of Newcastle, N. S. W., and had command at various times of various vessels of the Union Company of New Zealand. J. Robertson, who is to be the chief officer, has for a number of years been master of vessels trading between Australia and New Zealand. R. Sterling is the 2nd officer. He was chief officer of the "Seang Choon," which was torpedoed off the Scilly Islands in 1917. J. Clarke is the 3rd officer; for a number of years he has held a similar position with the A. U. S. N. Company and the Howard Smith Company, trading off the Australian Coast. The chief engineer is L. Stewart, formerly chief engineer of the Melbourne Harbor Trust, and more lately in the British service, where he was commandeered for the position on this vessel. The second engineer is H. R. Leffler, formerly chief engineer of H. M. A. patrol steamer "Alacrity" on the Australian Coast. The third engineer is A. W. Lucas, who was fourth engineer of the "Kilbride," which was torpedoed and sunk in the Mediterranean on March 1, 1916. He was also the fourth engineer of the "Feliciana," which was torpedoed on the Atlantic, April 21, 1916. R. Stalker is the fourth engineer. He joined the "Cethana" in America. For a number of years he was in the employ of the C. P. R. Company and also was identified with the Union Company at Vancouver, B. C. Oscar Nielson is to proceed to Australia with the "Cethana," as guarantee engineer for the McIntosh & Seymour Corp. He is a Diesel engine expert and has been in charge of erection of Diesel-engined power stations for his company in various parts of America.

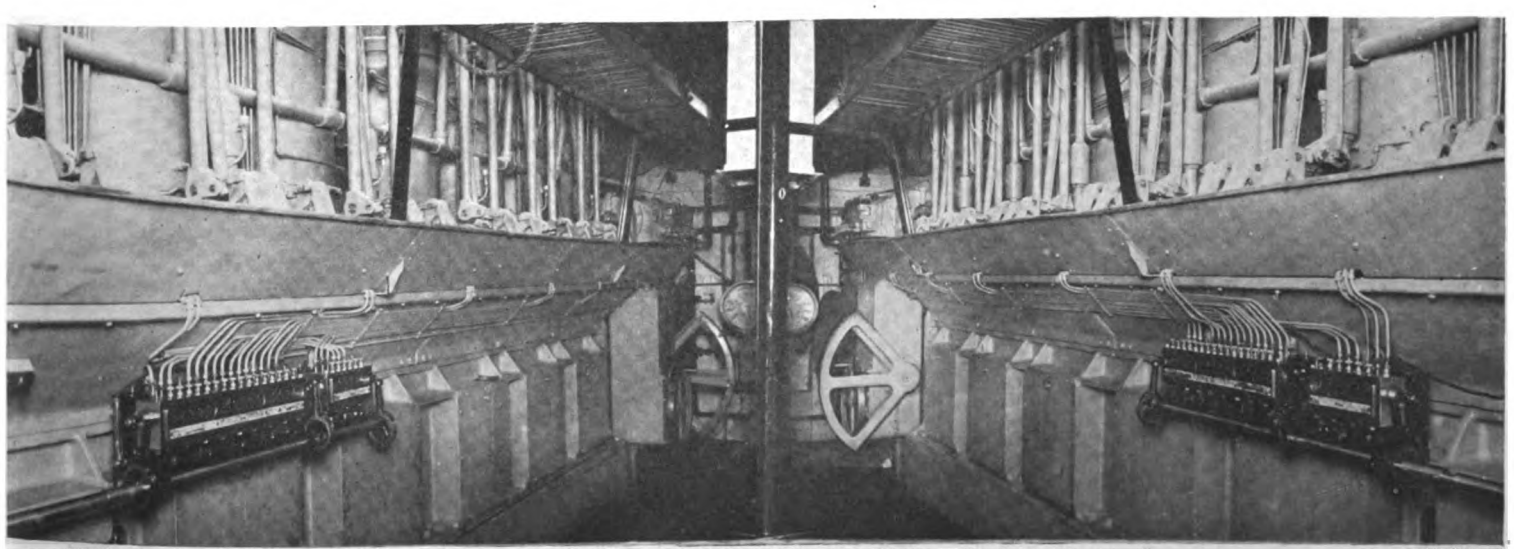
As in the case of many other recently built oil-engined vessels, "Motorship" is inclined to consider the "Cethana" and her sisters are underpowered, and that another 100 b.h.p. per engine would tend for greater reliability in service. The amount of power rested with the original owners.

SHIPPING BOARD INCREASES WAGES OF ENGINE-ROOM CREWS

Following the recent conference between representatives of ship-owners, licensed-officers and seamen, and the Shipping Board, it was announced by the Shipping Board that this standard wage scale for the deck and engine departments has been established:

	Per Month.
Deck Engineers	$85.00
Pump-Men	85.00
Refrigerating Engineers	95.00
Oilers	80.00
Watertenders	80.00
Engine-Room Storekeeper	80.00
Firemen	75.00
Wipers	65.00
Coal Passers	65.00

Straight overtime 60 cents an hour and $1.25 for meal money on shore is allowed. On vessels sailing into the war zone the war bonus shall remain fifty per cent (50%). The foregoing wage scale applies to all vessels sailing from Atlantic and Gulf Coast ports of the United States, except harbor craft and vessels owned or operated by the Navy. It shall be considered a standard wage scale for all such vessels.



ENGINE-ROOM OF THE "CETHANA" SHOWING THE CONTROL ARRANGEMENTS and the FORCE-FEED LUBRICATING SYSTEM

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New Type of Marine Oil Engine

An Example of Close Adherence to Steam Engine Design

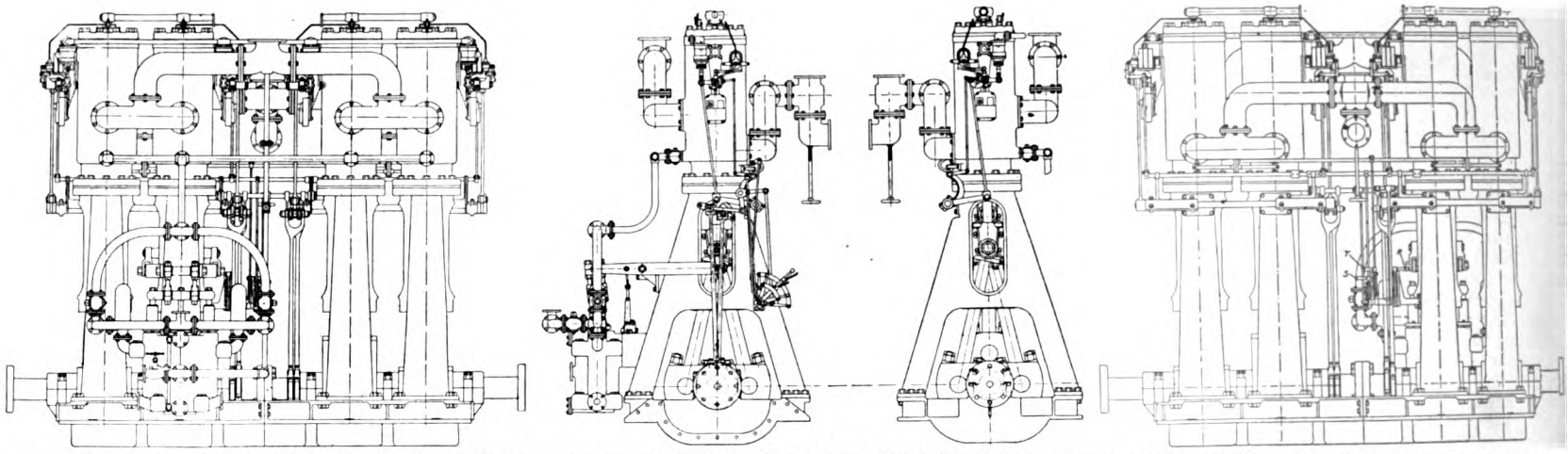
PROBABLY no marine oil engine yet has been designed which more closely follows steam practice than the American Whaley engine, so this new design is of more than ordinary interest. Because of the reversing mechanism adopted we understand that it is very easily reversed, and that it operates at any speed within its designed range; also that it picks up speed with the flexibility of a marine steam engine, yet without undue shocks and strains. It is not of the Diesel type, the cycle being more closely related to that of a marine gasoline motor.

This engine is, primarily, of the two-cycle type and of the three-port design, with all events taking place as in common practice. The charge drawn in is of a relatively rich mixture, compressed and fired in the usual manner. Due to this rich mixture, combustion takes place slowly. When at twenty degrees forward on the firing stroke a poppet valve admits compressed air, in any amount desired, which vitalizes the burning charge and prolongs combustion, so that the indicator card shows a long horizontal firing line, denoting a close approximation to constant-pressure combustion during the impulse stroke. The exhaust-port opens at nearly complete expansion and shows, it is claimed, a clear and cool exhaust discharge.

Reverse action of rotation is accomplished by the use of the Stephenson link—one set for each pair of cylinders. The operating levers are mounted on a floating-arc control-lever, and, by an ingenious device patented by the builders. the spark and throttle are brought into neutral position before reverse can be effected, thus acting as a safety-stop and preventing the possibility of unduly straining the crankshaft by torsion. Reversing is easily and positively effected within five seconds.

The only auxiliary required are the usual air-starting tanks maintained at 100 pounds pressure per square inch, and an air-compressor integral with the engine, the auxiliaries consuming approximately ten per cent of the engine power. Ignition is by jump-spark high-tension magneto, or by make-and-break system as desired. For high speed duty the engine may be built light and strong. For marine service the engine needs no fly-wheel, and any number of cylinders, within reason, may be furnished in multiples of two. We are advised that in all the preleminary tests the engine has shown that the parts are of such strength that they can take severe punishment without undue strain.

American Whaley Engine Co. of Boston, Mass., are prepared to furnish engines up to 5,000 h.p., and to run on producer-gas, kerosene, distillates or gas-oil, and other similar fuels.



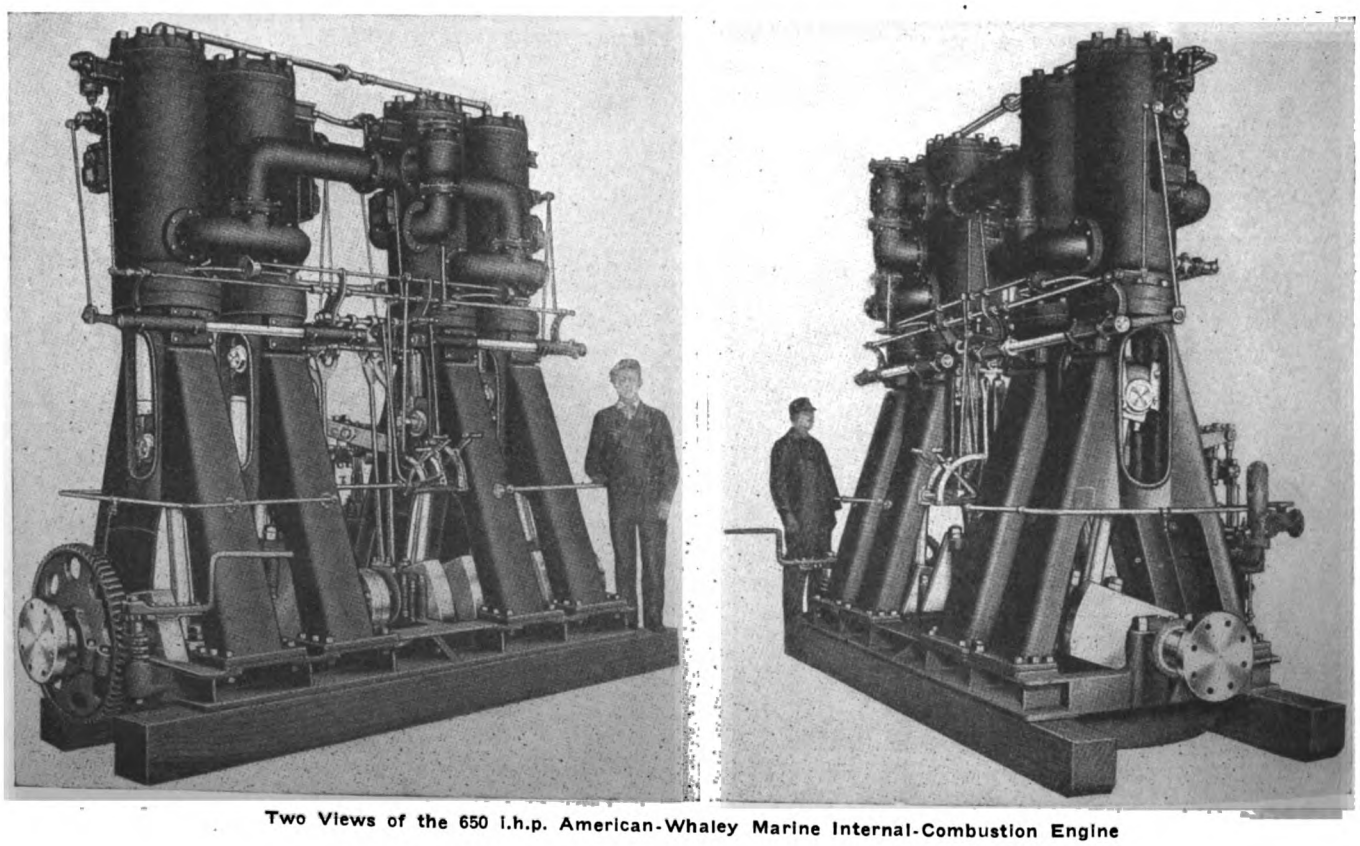
General Arrangement of the 650 i.h.p. American-Whaley Marine Oil Engine. It is of the Electrical-Ignition Type, so Quite Differs from Other Large Engines for Ships

OPERATION OF TWO-CYCLE TYPE SUBMARINE DIESEL ENGINES

Writing on his experiences, in *Power*, with the operation of two-cycle type submarine Diesel-engines, Lieut. F. C. Sherman of the U. S. Navy says that, "In spite of the widespread reports of unreliability of submarine Diesel-engines of the past few years, the writer has always maintained that every effort should be made to make the material operate satisfactorily before condemning it as unsatisfactory and unreliable. In many cases further investigation has shown that inexperienced personnel are to blame and not the long-suffering and almost always blamed material."

"Cracked piston-heads, cracked cylinders, cracked pistons, and piston seizures are almost all traceable to defective cooling of the piston head. On the particular type of engine in question, the pistons were cooled by lubricating oil forced up from the lubricating system through the connecting-rod and wrist-pin and then up through a pipe leading to the hollow piston-head and thence down on the opposite side through a drain pipe to the crank-case, whence it drains by gravity to the settling tanks."

"The most frequent cause of defective cooling of the piston heads was the presence of salt water in the lubricating-oil which remained in the piston-head owing to the location of cooling-water inlet and outlet. Due to the temperature to which the oil was subjected, the water would quickly evaporate, leaving a salt deposit in the oil which was black in color, giving the appearance of carbon. For a long time this deposit was thought to be carbon, on account of its color, but an analysis showed it to be over 90 per cent salt. This salt would form a black, gummy mass, and would soon collect in the piston-heads and in the pipes leading to them, and result in decreasing or blocking altogether the supply of cooling oil to the piston-heads, which would instantaneously get hot and either crack or seize. Or heat would travel to the cylinder or piston itself, resulting in cracking the cylinder with its cooling-water outside, or the piston seizing."



Two Views of the 650 i.h.p. American-Whaley Marine Internal-Combustion Engine

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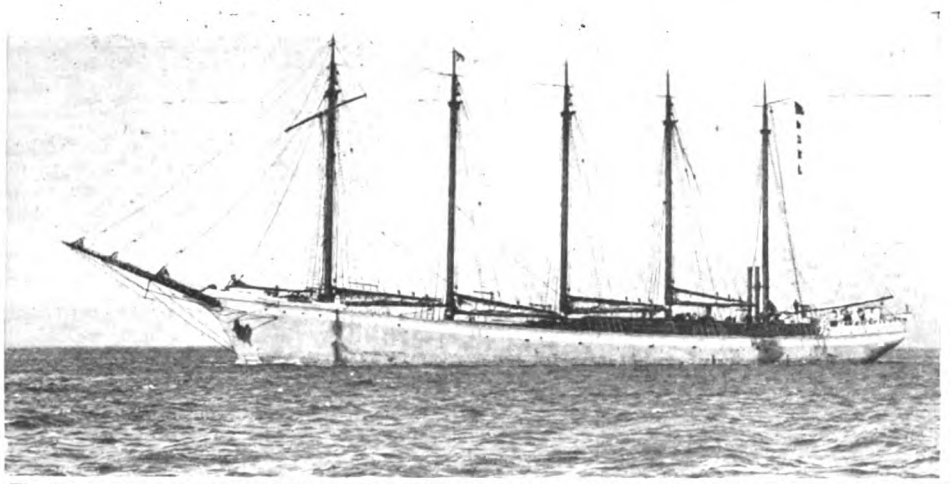
SHIPS OF THE "CITY OF PORTLAND" TYPE VERSUS THE U. S. STANDARDIZED WOODEN, COAL-BURNING STEAMER

REGARDING the wooden auxiliary motorships of the "City of Portland" type, the owners of which, after over a year's experience, firmly believe that such motor vessels will operate at a profit in competition with steel coal-burners in any part of the world, and it is of interest to compare the same with the U. S. Emergency Fleet Corporation's Ferris type standardized wooden steamship. The results reveal some very remarkable differences that are almost unbelievable, and which give food for profound thought.

	M. S. "City of Portland"	Ferris' Steamer
Length O. A.	278′ 0″	281′ 6″
Breadth	48′ 0″	48′ 0″
Loaded draught	22′ 4″	23′ 6″
Displacement	5,100 tons	5,800 tons
Actual cargo-capacity on long voyage (Not d.w.c.)	3,300 tons	2,775 tons
Indicated horse-power	850	1,400
Brake horse-power	640	1,200
*Speed	6 to 10 knots	10 knots
Daily consumption of oil fuel	24 bbls.	†131 bbls.

*Speed varies according to the utilization of favorable winds for auxiliary sails.
†Equivalent to amount of coal used.



The Oil-Engined Auxiliary "City of St. Helens." She is a Sister Ship to the "City of Portland," and to the "S. I. Allard"

It will be realized that, although the motor-vessel is much smaller and considerably cheaper to build, she can carry on a round voyage of about 32 days no less than 525 tons more cargo than the steamer. Yet, there is a saving of 107 barrels of fuel-oil per day. As fuel oil is at least $1.50 per barrel, this means $160.50 per day saving in the fuel-bill alone. Then again, there is a saving on the engineers and stokers. (N. B.—The figures regarding the "City of Portland" were supplied by her owners.)

Now the owners of the "City of Portland" realize that the power installed is too small, and that at least 1,000 b.h.p. should be fitted, which they will do with future ships. Supposing two surface-ignition oil-engines of similar type, or two four-cycle Diesel engines of 500 b.h.p. each replaced the present two-cycle surface-ignition oil-engines in a new and duplicate ship. The fuel consumption will only jump to 35-40 barrels per day, while the speed maintained on a trans-Atlantic voyage will vary from 8 to 12 knots; so that the average speed will work out in a year's operation to much the same as the wooden full-powered steamer. Yet, the additional fuel consumption for a month's voyage will mean but 50 tons, so that the motor auxiliary still can carry about 475 more tons of cargo than the Ferris' steamer.

Hence, for first cost, fuel-consumption, stand-by charges, operating costs, cargo-capacity, upkeep and earning powers the wooden steamer can in no way compare with a 1,000 b.h.p. Diesel auxiliary of the "City of Portland" class. Surely the matter is well worth closer investigation? [The report of the chief-engineer of this ship on page 31 is very interesting.—Editor.]

CRANKSHAFT VIBRATION OF HIGH-SPEED OIL ENGINES

In an interesting paper on "High Speed Internal Combustion Engines," read before the Northeast Coast Institution of Engineers and Shipbuilders, Mr. Harry B. Ricardo, B.A., referred to a simple solution of crankshaft vibration. He said: "There is yet another and frequently very troublesome source of vibration in six-cylinder engines, namely, torsional vibration of the crankshaft. This is due to the fact that the end of the shaft furthest from the flywheel is, so to speak, wound up when the maximum turning moment is applied to it and released when the pressure is released. At certain speeds this alternate winding up and release coincides with the natural period of the crankshaft, with the result that the shaft vibrates excessively and the reciprocating masses which are attached to it vibrate with it and impart their vibration to the whole structure. Such torsional vibration can be prevented almost entirely by the use of the 'Lanchester' damper, which consists of a small flywheel mounted loosely on the crankshaft and connected to it through the medium of a friction clutch as shown in Fig. 28. The flywheel rotates at a constant angular velocity, and any relative movement of the end of the crankshaft results in the slipping of the clutch. The damper does not prevent the crankshaft from being wound up and released, but it does effectively prevent it from continuing in a state of vibration. This damper has proved most effective on high-speed engines, and one has recently, at the author's advice, been fitted to a large slow-speed six-cylinder Diesel engine which torsional vibration of the crankshaft had proved so troublesome that the engine could not be used. Since fitting the damper this trouble has entirely disappeared, and the engine is now running quite satisfactorily."

In another part of his treatise Mr. Ricardo stated that "it is in the design of piston and its influence on other parts of the engine that the essential difference between the high and low-speed engine lies. It is not suggested that large gas or Diesel engines should immediately be built to run at piston-speeds of 2,000 feet per minute, although this piston speed is now common practice in gasolene engines, many of which have to work under the most severe conditions, and without any skilled attention. But the author feels confident that the piston-speed of large internal-combustion-engines might quite safely be increased to from 1,400 to 1,600 feet per minute, with the experience now available, and that without affecting adversely either their reliability or durability, provided that designers take advantage of the lessons which have been learned.

WHAT OUR FRIENDS OVERSEAS THINK

ONE of the oldest and best-known shipping papers recently made some interesting comments upon several recent editorials in "Motorship." On many points they agree with us, but on others they differ. We refer to the "Syren and Shipping," of London, England. They say, among other things:

> "We are whole-heartedly of the belief that there is nothing to compare with the Diesel engine for the propulsion of ocean-going cargo-vessels. But we do not lose sight of the fact that a great volume of coal-burning steam tonnage exists, and that it would be almost the height of economic folly to neglect to make the fullest possible use of it. The conversion of steamers from coal-burning to oil-burning is, as matters are, a sound economic proposal, and will continue to be one for a considerable time to come."

After concluding the comments on the articles published in "Motorship," our esteemed contemporary discusses its own viewpoint regarding merchant motor vessels, and the future of the oil-fuel situation. Coming from the pen of a shipping journal of over twenty years' experience, their remarks are of great interest and should bear not a little weight with those shipowners who still remain in doubt over the motorship controversy. The following is what they say:

> "A time was when the first duty of every commentator on motor engineering affairs was to impress users with the superior economy of liquid fuel burned in an engine. The fact is, however, now so well established that there is no need to argue the matter. The internal-combustion-engine is demonstrably superior to the ordinary steam-engine for most kinds of marine work, and is, besides, doing a wide and still extending range of stationary work ashore and afloat. That it will be more largely used than ever when the war comes to an end is certain."
>
> "There are, of course, as there have generally been, possibilities about its future, and the fear which chiefly oppresses them is that liquid fuel will be dear and scarce for many a day to come. In our opinion, the apprehended scarcity will not long outlast the war; when belligerent and neutral maritime countries have laid in their reserves it will be more plentiful than ever. Its price is bound, however, to be high until the abnormal demand slackens, and it is obviously that prospect which depresses the faint-hearted."
>
> "But, for their encouragement, it may be pointed out that the fact to be taken into account is not the price of oil as compared with the pre-war price, but the price of oil relatively to that of coal. Coal is a long way above its pre-war price now, and it will continue at its present level for a long time. That being the case, though far above its pre-war price, oil fuel will be relatively as cheap as ever. Our advice to people who are thinking about oil engines for after-war use, is not to be deterred from their purpose by fears about future oil supplies and prices, but to go on with their projects. There is not the least danger of an oil famine when the conditions become normal."
>
> "Some time ago we suggested that the State might do worse than include amongst its standard ships a Diesel-engined vessel. There are, of course, difficulties, and we do not regard them lightly. But the least of them is, in our opinion, that which was more or less officially cited recently on the other side of the Atlantic, viz.: that there is no time for experiments. It is true that in America very little has to date been done with big Diesels, and comparatively no experience is available."
>
> "In the United Kingdom, however, the position is appreciably different. One British-made Diesel is far past the experimental stage. Moreover, the Admiralty are now in possession of much data relating to the sea service of several other makes. In fact, it is not at all to exaggerate to say that the Engineer-in-Chief's Department is tolerably clear in its mind as to what the requirements are for a Diesel suitable to propel a sea-going merchant vessel, and also as to how they may be fulfilled. With the standardized designs running to about a dozen it would obviously affect progress in the provision of tonnage very little to lay down a Diesel ship or two. Moreover, if that were done, the United Kingdom's marine oil-engine industry would get exactly the fillip it needs and deserves."

We are inclined to think that some large Diesel-driven motorships have been built in British shipyards during the war. For instance, there is the "Santa Margharita" which, according to Lloyd's, was built in 1916 by Vickers, Ltd., for Mr. Thos. Royden, of the Cunard Co., and which is one of the largest cargo motorships yet constructed. Then again, it hardly is likely that the big marine Diesel-engine works of Harland & Wolff, at Lancefield Quay, Glasgow, have been idle. In fact, has it not been announced that they are building quite a large number of marine Diesel engines for a fleet of motorships for the Glen & Elder-Dempster lines?

For some strange reasons the British authorities will not allow any illustrations or details of new motorships and Diesel engines to be sent to America, although they freely permit data and pictures of new steamships to come here. Why on earth should they be reticent about motorships? To Germany, a ship is a ship if she can sink her, so we fail to see what "military" secret would be revealed by stating how many motorships are building in the British Isles, when figures concerning steamships constantly are given officially. Great Britain will not do herself any harm of she follows the example of the U. S. Emergency Fleet Corporation, whose motorship doings are detailed elsewhere in this issue. Perhaps our contemporary "Syren and Shipping" can explain? We are at a loss to see a reason for the discrimination!

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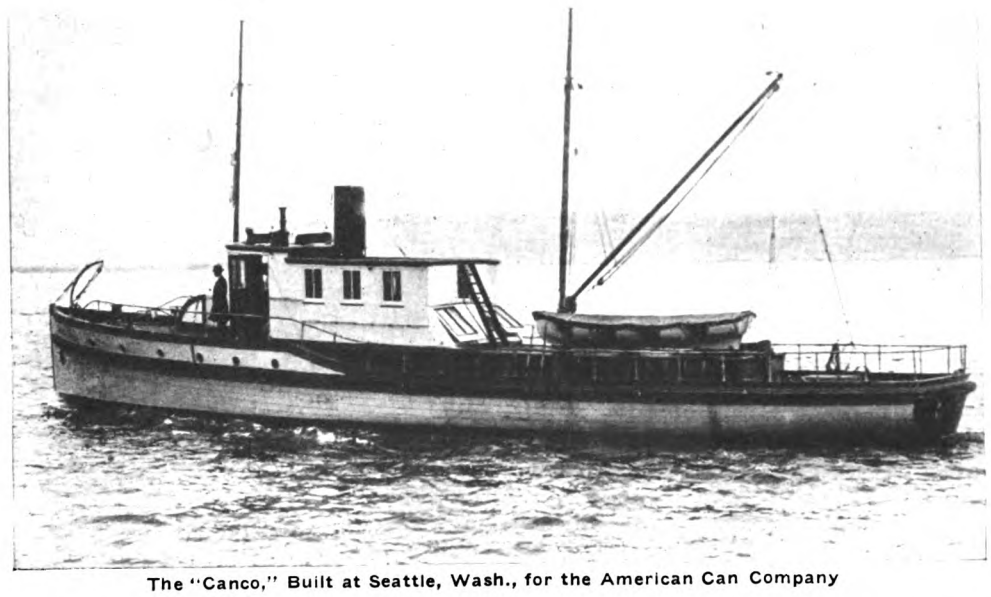
Oil Engines in the Alaskan Fisheries

A Number of Fairbanks-Morse Installations

REMARKABLE headway recently has been made by a domestic company in connection with the installation of marine, heavy-oil engines in Alaskan fishing-craft. We refer to the Fairbanks-Morse Company, whose Seattle agency report extensive business, much of which is repeat orders.

For one company alone, which operates salmon canneries, mild curing stations, salmon and herring salteries, the Southern Alaska Canning Company, six of their type "C-O" engines have been installed aboard their cannery tenders and tugs and the craft of their subsidiaries. The accompanying photographs show some of the installation made in boats which are to be operated in the commercial fisheries of Alaska and of which two, the "Einar Beyer" and the "Petrel," were built to the order of the Southern Alaska Canning Company. The other vessels built for this company in which Fairbanks-Morse engines have been installed are the "Fanshaw" with a 75 b.h.p. motor installed in 1916, the "Shamrock II," having a 45 b.h.p. motor installed in 1917, the "Shamrock III" equipped with an 100 b.h.p. in 1917, also an 100 motor which has not yet been installed, but which is on order and will be delivered shortly.



The "Canco," Built at Seattle, Wash., for the American Can Company

The remaining photographs are those of the "Frances E" built for the Tee Harbor Packing Company of Alaska, and the "Canco," a service boat which is now at work in Alaska for the American Can Company. Both of these vessels were built in 1918 and placed in operation within the last month.

The "Einar Beyer" is a wooden vessel, 90′x20′x9′ 2″, with a tonnage of 92 tons. Two holds are provided, one for fish just aft of the raised foc'sle head, where accommodations have been placed for eight men, the other hold being located under the after deck and is fitted up to take care of the vessel's supplies. The pilot house, captain's, and superintendent's cabins, toilet and a large and conveniently arranged combination galley and dining room are located on deck. In the after part of the engine-room are the accommodations for the engineers, which are fitted with electric light and have running hot and cold water, as are the cabins on deck.

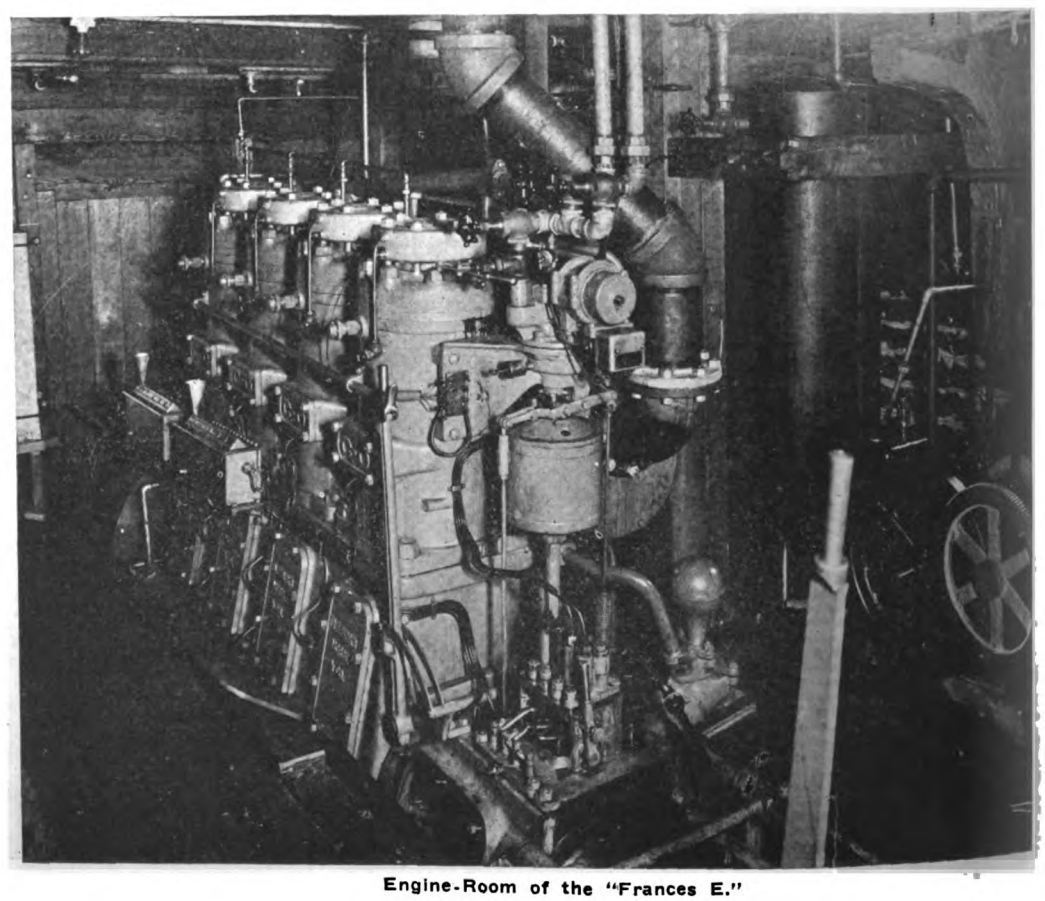
The engine-room of the "Einar Beyer" is one of the finest ever made in such a vessel. The 150 h.p. main engine and the auxiliaries are so placed as to give ample room for free movement of the engine-room staff. A simple control for all parts of the main engine has been placed at the forward end. On the port side of the main engine has been placed a 9 h.p. auxiliary, driving a 5KW Fairbanks-Morse generator. This supplies power for direct lighting. The motor charges a 56-cell Exide storage battery set, which in turn is used for lighting, for the deck, fire and bilge pumps, and also for the starting air-compressor. The deck machinery is electrically driven by means of this last-named arrangement. It consists of an anchor windlass built by the Markey Machinery Company of Seattle and a tow-bit with a live "niggerhead" built by the Vulcan Manufacturing Company, also of Seattle.

The fuel for the main engine will be Standard-Oil "Calol" and the lubrication-oil Fairbanks-Morse "Hytest." Ample fire protection aside from the fire pumps which were built by the Moran Company of Seattle has been placed at advantageous places over the vessel; Pyrene and Buffalo fire extinguishers being stationed here. It will interest Pacific Coast readers to know that the sale and installation of the motors of the "Einar Beyer" and of the other vessels were made by G. C. Craig of the marine department of the Fairbanks-Morse agency at Seattle. Within the last year he has made the installation of more than twenty engines of this make in the Puget Sound country.

The "Petrel" was built by the Elliott Bay Yacht & Engine Company and is practically a duplication of the "Einar Beyer" having the same dimensions and arrangements. She originally was ordered by the Southern Alaska Canning Company, but upon her completion was taken over by the Alaska Pacific Herring Company, a subsidiary concern. She is powered with a 100 b.h.p. motor of the type "C-O." Her auxiliary equipment is a duplication also of the "Einar Beyer." The "Petrel" will be engaged in the herring fisheries of Alaska. She will be on her way to Northern waters in the course of a few weeks.

The "Frances E" was built for the Tee Harbor Packing Company and is also to be used in the commercial fisheries of Alaska. She is powered with a four-cylinder, 100 b.h.p. motor running a three-blade 50″ wheel. Her dimensions are 73′ 6″ long, 17′ 6′ beam and has a depth of 8′ ″. Her arrangements are also the same as the "Einar Beyer"; but she has for auxiliary equipment a 3 h.p. Fairbanks-Morse engine which will drive the fire, bilge and fish-tank pumps. She started for Alaska June 24.

"Frances E," a Cannery Tender Owned by the Tee Harbor Packing Co.



Engine-Room of the "Frances E."

BRITISH SHIPS SUNK DURING 1917

No fewer than 1,189 British merchant ships and 213 British fishing vessels were sunk during 1917.

COASTWISE MOTOR VESSELS

During its seven or eight years' existence, the Coasting Motor Shipping Co. of Glasgow, Scotland, have had built about 20 steel coastwise motorvessels of 140 tons dead-weight capacity each, all of which are fitted with two-cycle crude-oil engines of the surface-ignition type.

H. M. S. "QUEEN ELIZABETH" HAS THREE DIESEL ENGINES

For the purpose of dynamo-driving, two six-cylinder Diesel engines built by Mirrelees, Bickerton & Day, are installed on the British battleship "Queen Elizabeth." A large Diesel engine built by Vickers also is installed for the same purpose, and this engine ran a 160 hours' trial in the builders' works.

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The Full-Powered Wooden Motorship "Alabama"

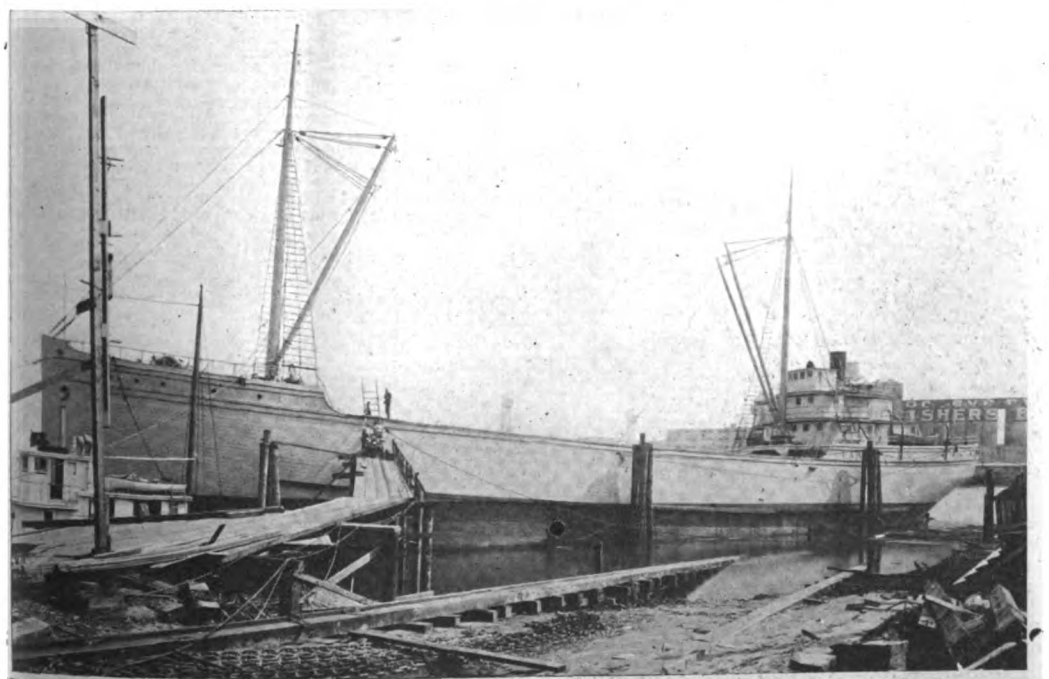
THE second full-powered motorship to be built by the Alaska Pacific Construction Company of Seattle, Wash., is the "Alabama," the installation of the main engines, of which is now nearing completion. She will be ready for her trials about the 25th of July, and it is said that she has been sold to France by her owners.

The "Alabama" is a staunchly-built wooden cargo carrier powered with two six-cylinder, four-cycle, reversible McIntosh & Seymour Diesel type heavy-oil engines of 500 b.h.p. each. This installation is the third to be completed on the Pacific coast having this size of motor built by the McIntosh & Seymour Corporation. Two other such installations are yet to be made in the remaining two of the four vessels built for the Australian Government by the Sloan Shipyards Corporation at Olympia, Wash. The "Alabama" is 270 feet long, has a beam of 46 feet and a moulded depth of 26 feet, giving her a deadweight capacity of 2,400 tons.

Having been designed for an efficient cargo carrier, her main and auxiliary power, as well as her deck-houses, are all located far aft. Two hatches have been placed, one well forward and the other amidships, each of which is served with two electric cargo-hoists made by the Pacific Machine Shop & Mfg. Company of Seattle. Quarters for a part of the crew and the oilers are stationed in the raised forecastle head. Practically all of the space of the 'tween decks and the hold is to be taken up with cargo, with the exception of the engine-room space. On the after part of the main deck is the storeroom for general ship supplies, and aft of this again is the officers' mess and the conveniently arranged galley which has many modern conveniences, such as running hot and cold water, and refrigerating equipment. The cook's quarters are just off the galley on the starboard side. On the starboard side of the galley is the ship's hospital and accommodations for four men. On the port side of the officers' mess is the crew's mess and one stateroom for four men, with similar arrangements as those of the crew located in the foc'sle.

On the upper deck are the quarters for the engineers, and for the wireless operator and his operating room. Two cabins, which are for emergency purposes, are situated on this deck forward. The captain's cabin, within which is the chart room, and the cabins of the officers, are on the bridge deck. Above the master's cabin on the hurricane deck is the pilot house.

The engine-room of the "Alabama," because of its being situated so far aft, is not quite so roomy as might be desired; nevertheless the two 500 b.h.p. six-cylinder motors and the auxiliaries make a very handy installation. Forward of the main engines and on the starboard side has been placed a small 40 h.p. auxiliary oil-engine driving a 25 KW generator, which is to be used for emergency purposes. The maneuvering air tanks are also placed forward of the main engines, one on either side. Aft of the main engines and placed directly over the keelson is a two-cylinder 75 b.h.p. type "Y" Fairbanks-Morse oil engine driving a 40 KW General Electric generator for the electric deck machinery and lighting. On the starboard side of this motor is the switchboard. The Richardson-Phenix filtering system is stationed above the main deck on a platform with the injection-air bottles. A description of the 500 h.p. McIntosh & Seymour motors similar to those installed aboard the "Alabama' was published in the January, 1918, issue of "Motorship."



The Full-Powered 1,000 b.h.p. Diesel-Driven Motorship "Alabama," Built by the Alaska Pacific Construction Company for French Interests

THE AUXILIARY MOTORSHIP "HJELTENAES"

Among recently built Pacific Coast auxiliary motorships is the "Hjeltenaes," which was the last ship built by the Grays Harbor Shipbuilding Company before the company was succeeded by the Grays Harbor Motorship Corporation. Designed by Monte Ward she is a sister ship to the "Balestrand" and was built at Aberdeen, Wash. She was towed to Seattle from Aberdeen to have two Sumner surface-ignition type, heavy-oil engines installed, installation being made by the Pacific Machine Shop & Mfg. Co., the engines being of 350 b.h.p. each. The trial trip was run June 20th, when she made over 8 knots to the satisfaction of her owners and charterers.

She is owned by a corporation composed of Norwegian interests and represented in this country by W. C. Bristol of Portland; but the "Hjeltenaes" is chartered to A. O. Andersen & Co. of Portland. She will load at Seattle with lumber, but her destination not published at this time.

SHOULD GOVERNMENTS OPERATE SHIPYARDS AND SHIPS?

Referring to the taking-over of the new Chepstow shipyard by the British Government Lord Inchcape recently stated—"I am convinced that the less Government officials or quasi-Government officials are permitted to interfere with trade the better will it be for the country and for its financial stability. This country has acquired its wealth through the enterprise and the industry of its people. It is the wealth of the people that is enabling the country to carry on the war. There is an idea in some quarters that the Government, through officials, could with advantage to the community carry on the business of the country. No more fatal error could be conceived. No greater delusion ever took possession of the human mind."

A few days previously Mr. Arthur Balfour said in a speech: "When you are dealing with an industry of a country, with its mines and other matters, and when you strip the whole of its fixed capital and everything which is necessary for the carrying on of its manufacturing industry, then indeed was committed an injury far deeper and far more difficult to heal."

"Motorship" is of the opinion that in controlling the construction of ships in America at this time, the United States Government has done a splendid and wonderful thing for the country; but we also have a deeply-rooted conviction that the operation of all merchant vessels should be placed back in the hands of experienced private shipping interests as quickly as possible, and this we believe the Shipping Board will do. However, we think that wherever possible private interests also should be allowed to build—"motorships"° With the training of additional men this should be easy to arrange without interfering with Federal shipbuilding.

The Motor Auxiliary "Hjeltnaes," Powered with Two 350 b.h.p. Sumner Oil Engines, on Her Trial Trip

EXTENSIVE MORTORSHIP SERVICE FOR THE BALTIC.

There are about twenty oil-engined motorships at present under construction in Swedish shipyards exclusively for the Baltic trade. Some of these are standard vessels of 2,500 tons dwc. which have Diesel engines for their propelling power. These 2,500-ton vessels are building at the Finnboda shipyard. At the Sodra Shipbuilding Works, Stockholm, a motorship of 1,500 tons dwc. was completed last year also for the Baltic service.

Other Swedish yards are constructing motorships of 700 tons dwc., which will be driven by 270 b. h. p. three-cylinder, two-cycle type reversible oil-engines of the surface-ignition class, and which will give a speed of about 9 knots, the machinery being installed aft. All will be completely equipped with electrical auxiliaries, including the anchor, steering-gear and cargo winches.

AUSTRALIA'S NEW MERCHANT MARINE

There will be added to Australia's present fleet of steam and Diesel-driven merchant ships, 35 to 40 new vessels during the next one or two years. Fourteen of these will be wooden craft of 3200 tons dwc., of which four are 1,000 bhp Diesel driven. The latter are now completing in the U. S. A. and McIntosh & Seymour oil-engines are being installed. It also is expected that a number of motor-auxiliary sailing-ships will be built.

THE GERMAN SUBMARINE U-121

According to men who were prisoners aboard the U-121, she is 210′ long, by 29′ breadth, and carries two 5.9″ guns and four rapid-fire guns. This closely tallies with the dimensions estimated by us in our June issue of the big U-boat illustrated therein.

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The Heavy-Oil Engine From a Scientific Standpoint

By Dr. CHAS. E. LUCKE

Part III. (*Continued from July issue.*)

Just to point out one or two things, to illustrate what I have in mind, consider the most widely used Diesel cast frame structure, extending from bed plate to cylinder head, and having an axially expanding cylinder liner. This cylinder liner is a stressed member, the stress being bursting stress, with 400 or 500 lbs. per sq. in., normal pressure at the top and possibly an accidental maximum pressure with a pre-ignition pressure of twice that 1000 or 1200 lbs. per sq. in.

Now, we certainly know how to build cylinders to withstand bursting so this is not peculiarly an oil engine problem, except that its expansion must not be restrained. That cylinder structure is inside of a heavy casting and held at the top. This casting is practically an "A" frame with a cylindrical extension at the top, the cylindrical extension forms the water-jacket and is faced at the top on which the cylinder liner flange rests. There is a slip joint at the other end of the liner to allow of longitudinal expansion of the cylinder liner barrel with reference to the jacketed frame. An engine built along such lines as this is fundamentally wrong, because this jacket is at the same time a frame. What is its principal duty? Its principal duty is to hold water—and anything that will hold water will do just as well—and yet you will find big engines with jacket walls of 1¼ in. cast iron for Heaven knows how many feet in diameter. Think of all the weight that goes with that, and for what?

To hold water and transmit an upward tension load from the cylinder head to the main bearing. You could not conceive of anything more fundamentally wrong. In the first place, as to the material: it is all cast iron and it is always in tension if it is loaded at all. If it were a steam engine there would be an alternate compression and tension; but here it is tension loaded, and if there is any worse material than cast iron for carrying a tension load, it is probably cast aluminum. Furthermore, if such a cylinder liner barrel is strong enough to resist bursting, it has just got twice the factor of safety for the longitudinal tension stress which means that the double metal or liner and jacket is entirely unjustified. The cylinder should be held to the frame at the crank end and the jacket eliminated as a stressed member. There is no reason on earth for carrying a heavy cast iron wall for a jacket when ordinary tank steel will do the job as well and a little bit better. We have oxygen welding apparatus that will enable us to weld the edge of a thin sheet to cast iron with perfect success and with not much expense, either.

I see then a necessity for changing the cylinder to take off the foolish, unnecessary weight. Do you know that some of these engines of stationary form—the class that I am condemning—weight 600 lbs. per horsepower? Think of it! Six hundred pounds per horsepower!! It looks as if some body owned an iron foundry. And when these same engines are refined down for ship work, without changing the type of structure, just the same typical arrangement but reducing the bed plate and getting rid of flywheels, they come down to about 150 lbs. per horsepower.

But there they stick. To go below that it is necessary to change the structural arrangement to conform more and more nearly to the standards of steam practice—the better, more refined class of steam practice, and notice—the better, more refined class of steam practice, and we have in this country most excellent models for them and all we have to do is to follow them out and keep within the same method of calculating loads and factors of safety—keep the same factors and the resulting work just as well as in the steel. Now, that means not only the taking away of this cast jacket and making the cylinder barrel carry the two kinds of stress—the bursting and the longitudinal at the same time, which it is perfectly able to do—but it means also to take this heavy cast-iron frame structure away from the space between the cylinder end and the bed-plate and to substitute for it the steel rod construction of the torepdo boat or yacht engine—to mention the two most highly developed forms of that structure. To be sure, that type of engine is not a stiff engine. Certainly the cylinders are going to sway and weave. But what of that? Where did these oil engine designers get the idea that this thing had to be a stiff structure, like a brick wall? I do not know where, but they got it, and there it sticks.

The most successful engines we have today, and the most wonderful machines, I think, that we have ever designed are steam locomotives. When you consider what they have to do and how well they do it, they are truly wonderful. What would happen to a locomotive that was built stiff? And what would happen to the rails on which it runs? You would have neither locomotive or rails at the end of the run. The steam engine that I speak of—that gives years and years of service and is regarded as a model of reliability, carrying a ship trip after trip, back and forth across the ocean like a ferry boat—is that a stiff structure? It is not; it weaves and twists, but that does not hurt it. Why then should we insist upon the cast iron stiff structure for oil engines? There is no reason on earth why we should. So I say that we can take the steam engine structure from bed plate to cylinder and design and apply it to oil engines, selecting dimensions to give similar elastic factors, bearing loads, and so forth, and it should also give equal success.

After these two changes it will be time to remove the outside cast wall of the head. By taking the cast head jacket away from the top of the head we will free the valve housings, the intake and starting valve. These will then be exposed, and the present elaborately cored casting eliminated. These cored heads are so awful that I do not blame the foundrymen and molders for doing with them what they always do when they get into a corner with cores that are too intricate. they knock a piece off; and then we wonder why the head overheats. The designer thought he had provided for water but the molder could not get it there and the designer is responsible for asking a molder to do what no man could do. In proportion as that casting is made easy to mold so it will be a good job. By means of the oxygen weld, the whole cylinder head top can be left off and the only cores left are the cores for the intake and exhaust, which are easy cores. Then you will get a clean casting which can be inspected on both sides and free of bad shrinkage stresses, and a sheetjacket welded around the edges, and you will have a real job.

Just as an indication of what happens when this thing is carried out, even in part, I will tell you that the most highly developed of these oil engines today are the submarine engines. In those engines the heavy cast frame structure has been—in the better of them—removed, and as a consequence of the steam engine practice as to frame structure, those engines, which, in the older form of all engine structure, weighed 150 lbs. more or less to the horsepower, have come down to what. Thirty-five or forty pounds per horsepower. That shows that we are getting somewhere. They still, however, are carrying the cast iron jacket and a cast iron roof to the head, so there is room for saving some more without doing any harm whatever.

I could go on to considerable length, but only at the expense of tiring you with a discussion of further details, all of which would only confirm what I have stated and what I have shown you—that there is room for lots of improvement and along perfectly simple and logical lines, if you only get down to it.

To conclude, then, I will say a word or two about the auxiliaries—especially with ships, because you may get a perfectly fine engine, and by wrong kinds of auxiliaries or wrong arrangement of auxiliaries have an awful hard engine room to work. The tendency for some time has been to regard the engine structure, when it comes to auxiliaries, as a sort of Christmas tree on which you hang anything that you want to use. If they decide to put a fire-alarm in the engine room I have no doubt that they would stick it on the engine somewhere. You find circulating pumps, air compressors, water pumps for circulating water, and oil pumps, in some cases bilge pumps—all hooked on to the main structure of the engine, which, in some cases and quite a number is two cycle, with a row of scavenging cylinders struck along one side, so that they resemble the old river boat engines. It certainly makes a weird combination, and in the old day steam engine practice they did just that thing.

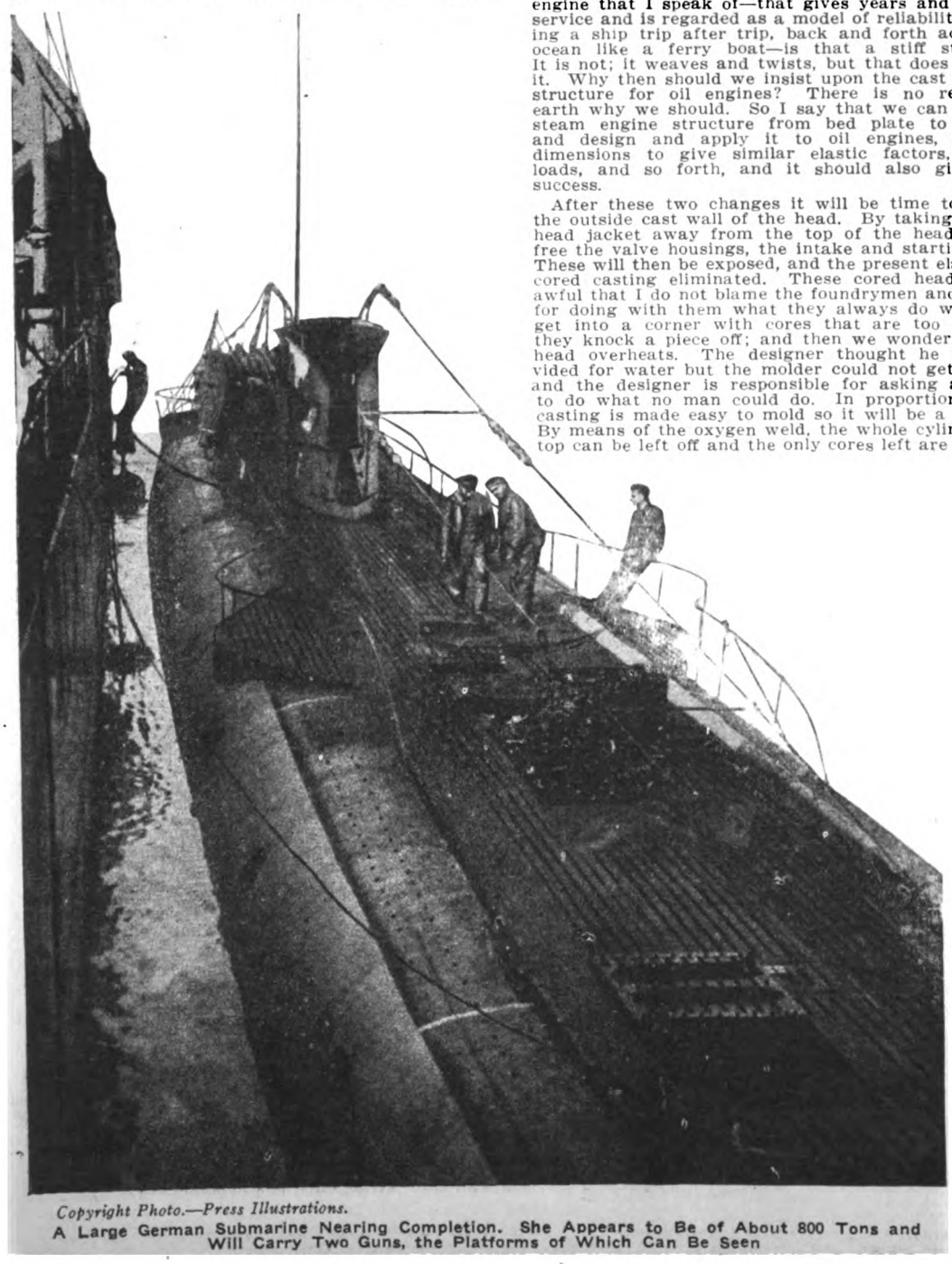
They carried feed pumps on the engine, condensers were mounted on the engine, hot well and circulating pumps likewise. It took us 150 years to get rid of that arrangement and it is no longer standard practice. I say that the engine structure should be preserved and respected as an engine structure, and not interfered with at all by hanging any kind of trimmings on it that have the slightest possibility of interfering with access to the engine. Doubly so is that true when the auxiliary attached to the engine does not and cannot behave right as attached.

In the latter connection I would call your attention particularly to the circulating pump for water. When the circulating pump for water is driven off the engine, either by its own crank or by rockers and links from other moving parts, then when the engine stops the water stops, and when the engine starts the water starts. Now, that might seem to be a desirable thing at first glance. As a matter of fact it is positively dangerous, and many cracked heads and cylinder heads can be traced to that cause alone; because consider the interior of a cylinder when the engine is running at full power, and you will see that there is some hundred pounds of metal very hot—quite hot in proportion as it is thick. Now, when the engine is shut down heat is there as insensible heat of the metal, and the jackets are full of water—X pounds of water and V pounds of hot metal. If you sit down and figure out the weights and heats involved, you will find in a big engine there is enough heat in the metal to evaporate all the water to steam and you would still have some left to conduct out to more distant parts, which should be odd—parts which are designed to be cold, which, when hot, crack. Especially is that true when after such a shut down and a general heating, somebody starts the engine and shoves a lot of cold water up against these surfaces. That condition can be eliminated only by completely independent jacket water circulators, separately driven by another engine, which permit the running of the water as long as water comes out from the discharge with any rise in temperature over the intake. In other words, the water should be continued through such an engine until it ceases to become warm, and that may be from 20 minutes to half an hour after the shut down, depending on the size and style of machine.

A similar discussion could be carried on about other auxiliaries, but I won't do it; I will cut it snort here on the assumption that I have pointed out that this question of auxiliary arrangement and starting by an auxiliary engine is just as important for study as the engine itself. There is just as much room for improvement as in the engine structure, as a structure, or the engine parts that are concerned with its functional operation.

Getting back now to the beginning, it must be admitted, and the more you study it the more willing you will be to admit it, that while we have made very considerable progress with the heavy oil engine that that progress is by no means ended. In fact, I believe that we can go much farther yet than we have already gone and that we can make the heaviest oil engine meet conditions that it has heretofore failed to meet. (Conclusion)

[The discussion on Dr. Lucke's valuable article will follow in the next issue of "Motorship."—Editor.]



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A Large German Submarine Nearing Completion. She Appears to Be of About 800 Tons and Will Carry Two Guns, the Platforms of Which Can Be Seen

EXPLOITS OF THE U-35

Commander Von Arnauld de la Periere of U-35 claims to have sunk 196 vessels of about 1,000,000 tons dead-weight-capacity, with this one submarine in the Mediterranean. But, he could not have done so if his Diesel engines were unreliable.

TURKEY TO BUILD SMALL MOTORSHIPS

A motorship building company, strongly backed by the Turkish Government, has been formed in Turkey and has a capital of one million dollars. Wooden motor-vessels of 100 to 200 tons capacity will be laid down.

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Some New Concrete Motorships

NORWAY IN RACE FOR CONCRETE SHIPS
Twelve Additional Oil-Engined Motor Vessels Building at the Fougner Yards

Norway is racing with America to see which country will gain the honor of building the first concrete vessel that will cross the Atlantic Ocean. America is far in the van of the shipbuilding world in regard to the number of concrete ships and their size that are being constructed at the present time, but Norway's vessels are economical motorships, whereas most of the U. S. vessels are uneconomical steamers. Mr. Nick Fougner, President of the Fougner Concrete Shipbuilding Company, of Christiana, Norway, states that he hopes to cross the Atlantic on one of the larger boats which his company is building within the next two or three months.

The concrete ship is fast coming to the front in Norway. The shortage of wood and steel in that country has made it necessary for shipbuilders to turn to the concrete vessel in order to offset the losses suffered by the depredations of the U-boats, if they desire to continue both their coastwise and trans-Atlantic trade. The "Stier," a 600-ton concrete motor vessel recently built at the shipyards of the Fougner Concrete Shipbuilding Company, is a pioneer of the type of large concrete vessel that is now under construction in Norway.

The vessel is 145 ft. overall, 27 ft. 6 in. beam, 15 ft. 9 in. moulded depth. It is equipped with one Bolinder marine heavy-oil engine of the surface-ignition type, of 160 b.h.p., and has four water-tight transverse bulkheads of concrete which, with a reasonable cargo, makes the ship practically unsinkable. She is owned by the Leibyde Steamship Co. and will receive her official certificate after she has completed six voyages.

At present the Fougner Company has under contract twelve additional sea-going concrete motorships, varying in size from 200 to 3,000 deadweight, and they have built and launched about 25 floating craft of various types, including tugs, lighters, motorships and dry docks.

It is expected that the Norwegian builders will adopt the new protective coating which when applied to concrete makes the life of a concrete vessel equal in durability to that of a steel vessel. This discovery so important in the construction of concrete vessels, has been the result of the research work of the engineers of the Emergency Fleet Corporation.

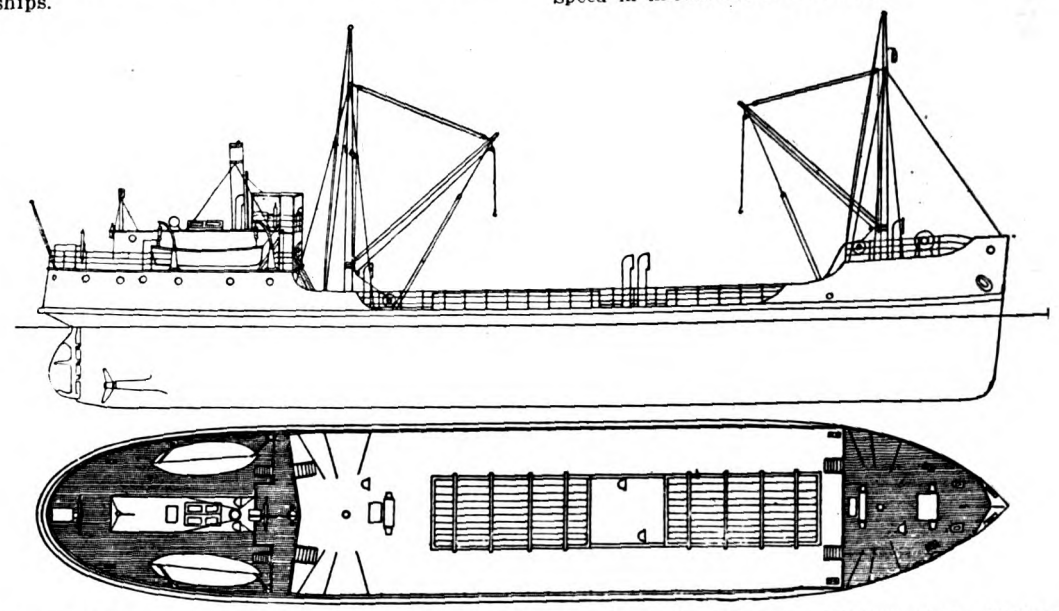
DANISH CONCRETE MOTORSHIPS

It is reported that among companies formed in Denmark to build concrete motorships, the Codan Company is erecting a yard at Kjoge, where ferro-concrete vessels up to 1,000 tons d.w.c. and wooden ships up to 600 tons d.w.c. will be built. The managing-director is Thorning Christensen. The capital of the company is about $250,000.

LARGE CONCRETE SHIPBUILDING CO.

Starting with a capital of $725,000, the Internationale Gewapendbeton Scheepsboun Mij. has just been formed at Rotterdam to build ferro-concrete ships.

Length over all	250 feet 0 inches
Length between perpendiculars	240 feet 0 inches
Breadth moulded	32 feet, 6 inches
Depth to top of main deck	21 feet, 3 inches
Height between deck	7 feet, 6 inches
Designed load draft	16 feet, 0 inches
Dead-rise	6 inches
Sheer forward	3 feet, 9 inches
Sheer aft	1 foot, 3 inches
Deadweight carrying-capacity	1,600 long tons
Horsepower in brake horsepower	500 b.h.p.
Speed in knots	9½ knots



A 1,000 tons d.w.c., reinforced concrete motorship recently built at the Jernbetonskibsbyggeriet's Dockyard, Greaaker, near Fredriksstad, Norway. Length 170' 3"; Beam 31' 10"; Depth 18' 0." She is equipped with two 160 b.h.p., Bolinder oil engines.

CONCRETE MOTORSHIPS AT HOUSTON

Apropos the reinforced concrete motorship building by the Houston Bank and Trust Company at Houston, Texas, and referred to on page 20 of our July issue, the power of this vessel has been changed, and a McIntosh & Seymour Diesel engine of 500 b.h.p. now will be installed in place of the smaller engine of the same make that originally was ordered. Furthermore, this vessel will be of 1,500 tons dead-weight-carrying capacity and a speed of 9½ knots is expected. Others will be laid down if the first vessels prove satisfactory, and materials are being purchased for the second motorship.

The first motorship has been named "Vernoghn," and her dimensions are as follows:

The vessel to be a single-screw motorship, built in conformance with the rules and regulations of the American Bureau of Shipping for a steel sea-going vessel of equal dimensions, the scantlings required for said ship being taken as a basis of comparison for computing the equivalent strength for the reinforced-concrete construction. The ship will be a double-decked vessel with forecastle, bridge, and poop, "Texas" amidships, with radio-room, hospital, and pilot-house and bridge above "Texas.' She has accommodations for fifty passengers and is rigged with two short pole masts to carry the wireless and the signals.

The hull will be subdivided by seven water-tight bulkheads into eight water-tight compartments; fore peak four frame spaces long; the first cargo-

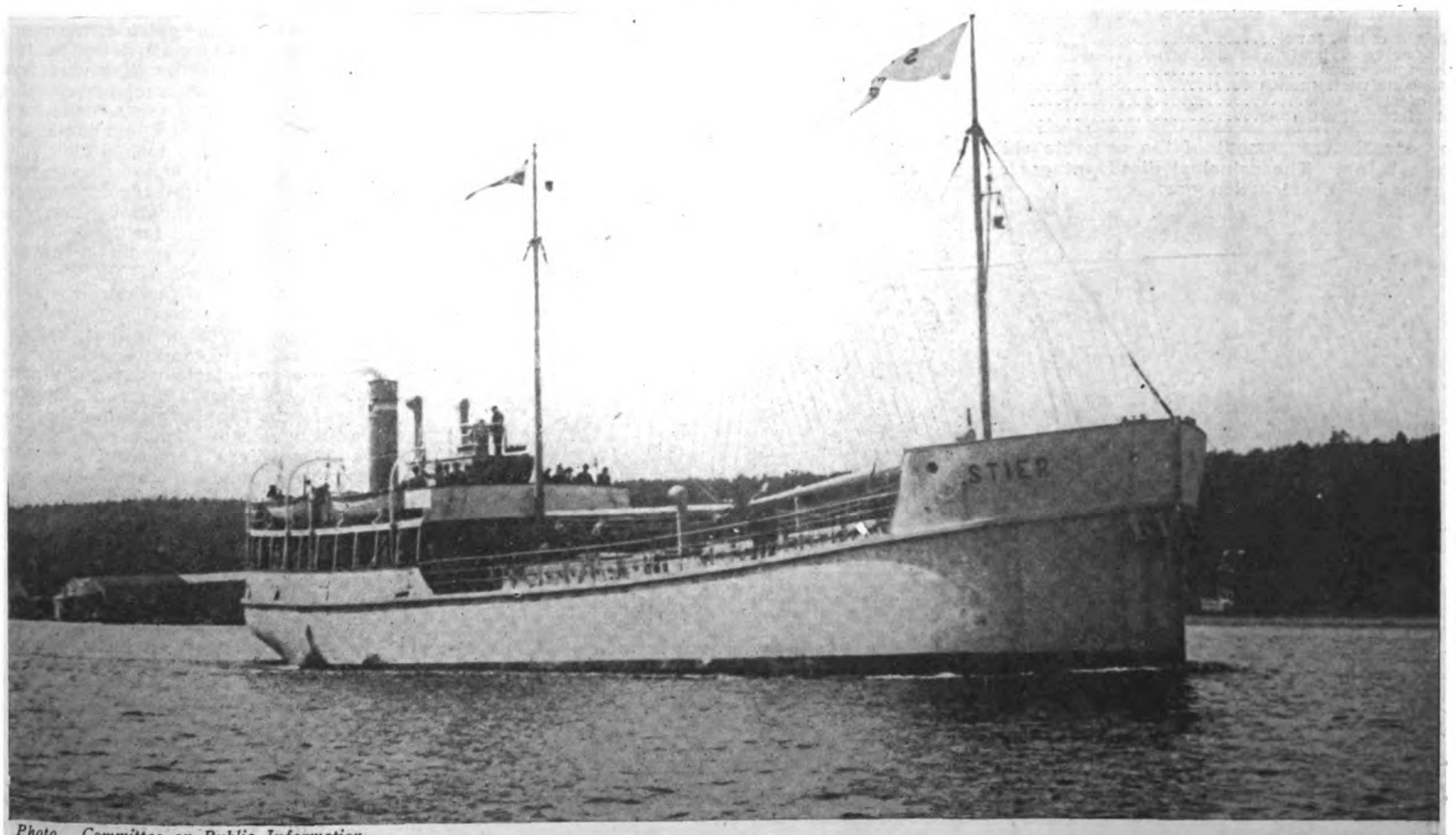


Photo. Committee on Public Information.

The Norwegian-built concrete motorship "Stier,",constructed at the Fougner shipyard, Christiania. Her cargo holds have a total cubic capacity of 31,178 cubic feet of bales or 33,958 cubic feet of grain. At present she carries saltpetre and limestone for the Norwegian Government.

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room nine frame spaces; the second cargo-room twelve frame spaces long; the third cargo-room thirteen frame spaces; the fourth cargo-room eight frame spaces; the engine-room eight frame spaces; the fuel-oil tank-room three frame spaces, and the afterpeak three frame spaces long; all frame spaces to be four feet centers. So her engine-room will be 32 feet long.

THOUSAND-TON CONCRETE MOTORSHIP LAUNCHED

The 1,000 tons reinforced concrete motorship building at the Jernbetonskibsbyggeriet Dockyard, Greaaker, Fredriksstad, Norway, was recently launched. Her dimensions are as follows:

Length, b.p.	170′ 3″
Breadth, moulded	31′ 10″
Depth	18′ 0″
Power	320 b.h.p.
No. of screws	Twin

The power installed consists of two Bolinder surface-ignition heavy-oil engine, each of 120 b.h.p.

AUSTRIAN CONCRETE SHIPS.

Even Austria has started to build concrete motorships, and at Spalato a vessel of 150 tons dwc. has been launched, and other vessels up to 1,200 tons dwc. are under construction.

MORE AMERICAN CONCRETE SHIPS

A shipyard for the construction of concrete vessels and barges is to be erected at Cleveland, Ohio, by the Cleveland Builders Supply Co. The ships will be 2,000 tons d. w. c. and the barges of 1,200 tons capacity.

CONCRETE SHIPS IN IRELAND

It is reported that the British Government has ordered six 1,000-ton concrete ships to be built in a new shipyard on the North Irish Coast.

GERMAN CONCRETE SHIPS

The first large German concrete ship has been launched at the Hamburg Eisenbeton Shipyard for the German Admiralty. It was designed by Mr. Runder. An Austrian subsidiary company also has been formed.

The Weys-Freytag A. G., a strong German concrete concern, have turned their attention to building concrete ships on a fairly extensive scale.

NEW CONCRETE MIXTURE

The U. S. Emergency Fleet Corporation has developed a concrete mixture which will produce a ship 20 per cent. lighter than a wooden vessel. The aggregate from which this new concrete is made is so light that it floats on water, yet it makes a kind of concrete possessing twice the strength of that used in ordinary building construction. With this development the concrete ship will come into more direct competition with the steel ship. Furthermore, that the discovery of a protective coating for the new fleet of concrete ships that the Emergency Fleet Corporation is building will make these ships as durable as the big steel vessels now crowding the ship ways of the country, is the expert opinion of R. J. Wig, Chief-Engineer of the Concrete Ship Division of the Emergency Fleet Corporation.

CONCRETE SHIPS

It is said that six concrete tankers are shortly to be laid down by the Torcrete Shipbuilding Co. (Mr. Theodore Ahlborn, naval architect), 1034 Continental Commercial Bank Building, Chicago, and that they are to be Diesel-driven.

Reinforced Concrete Vessels

By WALTER POLLOCK

IN a paper recently read before the Institute of Naval Architects of England, Mr. Walter Pollock gave a short historical sketch of the pioneer work of construction of this class of vessel, and states that in Norway a 5,000-ton d. w. capacity vessel is now being built, but he fails to see the advantage of using concrete in this case, as the amount of steel required will probably amount to 75 per cent. of that of a steel ship of the same d.w. capacity, and that, therefore, it is hardly probable that large vessels will be constructed of concrete as soon as the critical situation as regards steel and skilled labor is passed. This figure of 75 per cent. does not agree very well with that given by Major Denny, who quotes 680 tons of steel in a reinforced concrete ship of 5,830 tons d.w. capacity, as compared with 1,920 tons in a steel ship of 7,010 tons d.w. capacity.

Speaking on the question of "sectional" versus "monolithic" methods of construction, Mr. Pollock is evidently of the opinion that the latter is preferable.

Comparing a 300-ton d.w. capacity auxiliary coaster in reinforced concrete with similar boats in wood and steel, the following table is given, showing the principal dimensions and features of these vessels:

	Reinforced Concrete.	Wood.	Steel.
Length	125 ft. 0 in.	108 ft. 0 in.	105 ft. 0 in.
Breadth	25 ft. 0 in.	23 ft. 9 in.	21 ft. 0 in.
Depth	11 ft. 9 in.	11 ft. 7 in.	11 ft. 4 in.
Draught bottom of keel aft	10 ft. 3 in. (no keel)	10 ft. 3 in. (keel)	10 ft. 3 in. (no keel)
Deadweight cargo, tons	300	300	300
Cubic capacity of holds and hatchways, feet	17,320	12,350	12,500
Displacement, tons	640	495	455
Time to construct, months	4	8	6
Weight of steel, tons	28½	15	110
Weight of bare hull, tons	290	140	120

The general arrangement of the concrete ship is shown below. **The principal disadvantages of this method of construction are:**

(1) Greater weight, and consequently greater displacement for same deadweight.

(2) Increase of net tonnage and consequent increase in port and harbor dues.

(3) Increased cost of building and launching ways.

(4) Longer time to repair if bottom repairs are necessary.

The advantages are:

(1) Much less steel than is necessary for a steel vessel, and no waste due to scrap.

(2) No loss of strength due to rivet holes and joints.

(3) Cheaper and quicker construction.

(4) Very little skilled labor.

(5) Longer life and reduced depreciation.

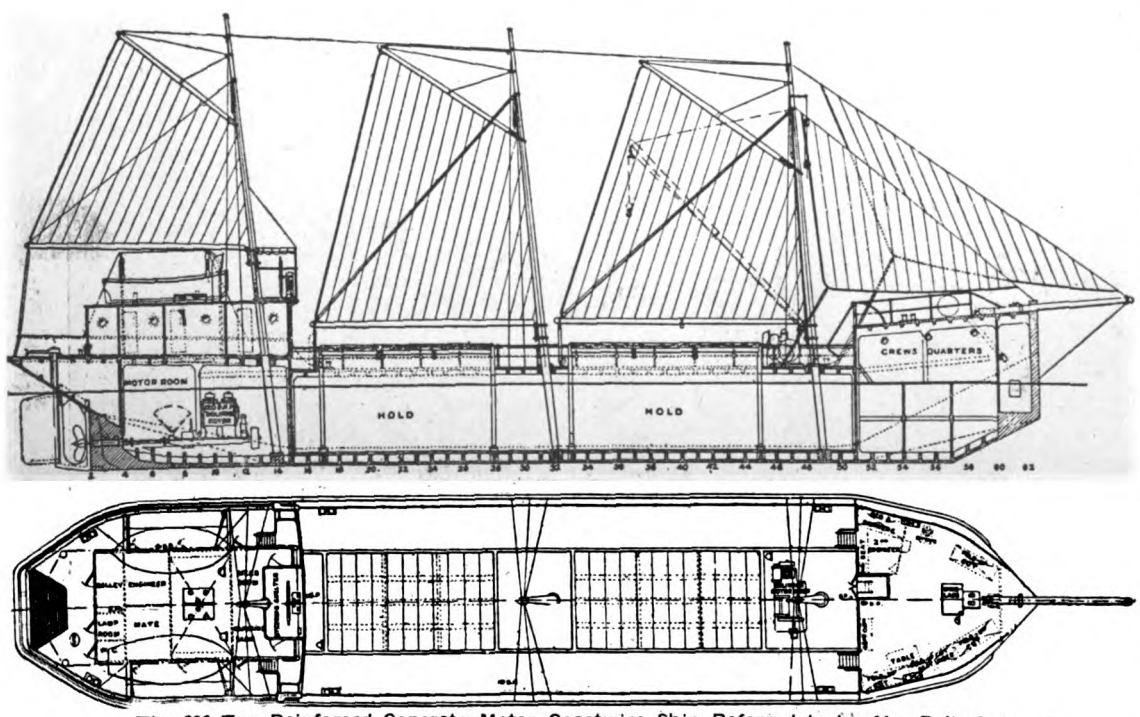
(6) Reduced upkeep and repair bill.

(7) Freedom from dry rot as in wooden vessels and corrosion as in steel vessels.

(8) Smoother surface and less skin friction.

The question of launching is a very important one for these ships. The best method is to build the vessel in a dry dock and float her out. If this is impracticable, the next best method is to launch her broadside on.

As regards the cost of construction, taking the hull complete and comparing it with steel and wooden construction, Mr. Pollock states that, even if steel is obtainable at £11 15s. per ton, concrete vessels of the same deadweight should, if standardized, be constructed at 20 per cent less cost than a steel vessel and 10 per cent less than a wooden vessel.



The 300-Ton Reinforced Concrete Motor Coastwise Ship Referred to by Mr. Pollock

NEW HOME OF THE PACIFIC MACHINE SHOP & MANUFACTURING COMPANY

In order to relieve the congestion resulting from the steadily increasing volume of business and to facilitate the manufacture and handling of their products in as efficient a manner as possible, the Pacific Machine Shop & Manufacturing Company of Seattle, Wash., have recently acquired the holdings of the former National Engineering & Equipment Company at 7500 Carleton Avenue, Seattle, which has closed out its affairs. In the former plant of the company it was found that the facilities were entirely inadequate to handle the present volume of business several months back, and it was decided by the officers of the company at that time that if any increase was to be taken care of in a proper manner an enlargement of their plant would of necessity have to follow. The closing out of the business of the National Engineering & Equipment Company and the subsequent releasing of their property afforded the opportunity for which they were looking for. A deal was closed and the Pacific Machine Shop & Manufacturing Company immediately began to move their tools into their home. The new plant is an admirable one in many ways, having been built for just such purposes as the present owners will put it to, the early part of the present year. It has an admirable location near the centre of the new manufacturing and shipbuilding district of Seattle. It has also excellent rail and water communications.

The plant covers six acres of ground, and comprises four buildings. The main and largest building is the machine shop, a building 80 by 200 feet containing the machine tools. This building also houses the main office of the company situated at the entrance on the main floor. Above the office on a balcony floor are the draughting rooms, which have excellent lighting facilities. On the same side of the machine shop on the ground floor is a well-equipped tool shop. On the balcony floor above the tool shop is the store room for general supplies. On the south side of the machine shop and on the balcony floor is the machine shop for light machine work and the electric equipment shop, where the electric parts are made or are assembled. The main floor of this building is taken up by the heavier machine tools, such as the 66″ Patch open side planer, the 60″ Niles Boring Mill and a 36″x30″ American heavy-duty lathe.

Through the middle of this building and running through its entire length is a 10-ton electric Milwaukee crane, which is so placed as to serve the entire shop. Directly behind the machine shop is another building, the steel shed which is 100 feet long and 80 feet wide. In this building are the tools for sheet steel work, such as the large steel rolls and breakers. It also contains a large Ingersoll Rand air-compressor for pneumatic tools. To the south of these two shops are the blacksmith and pattern shops, both of which have splendid equipment. Each is 30′x30′. The officers of the company are Allan Cunningham, President and Manager; G. Swet, Assistant to the Manager, and Geo. Steiner, Secretary and Treasurer. During the last twenty months this company have built and installed over 150 electric cargo-winches and 50 anchor-windlasses. They also make a specialty of installing oil-engines, having within the same period installed the main engines and auxiliaries in six or eight motor auxiliaries.

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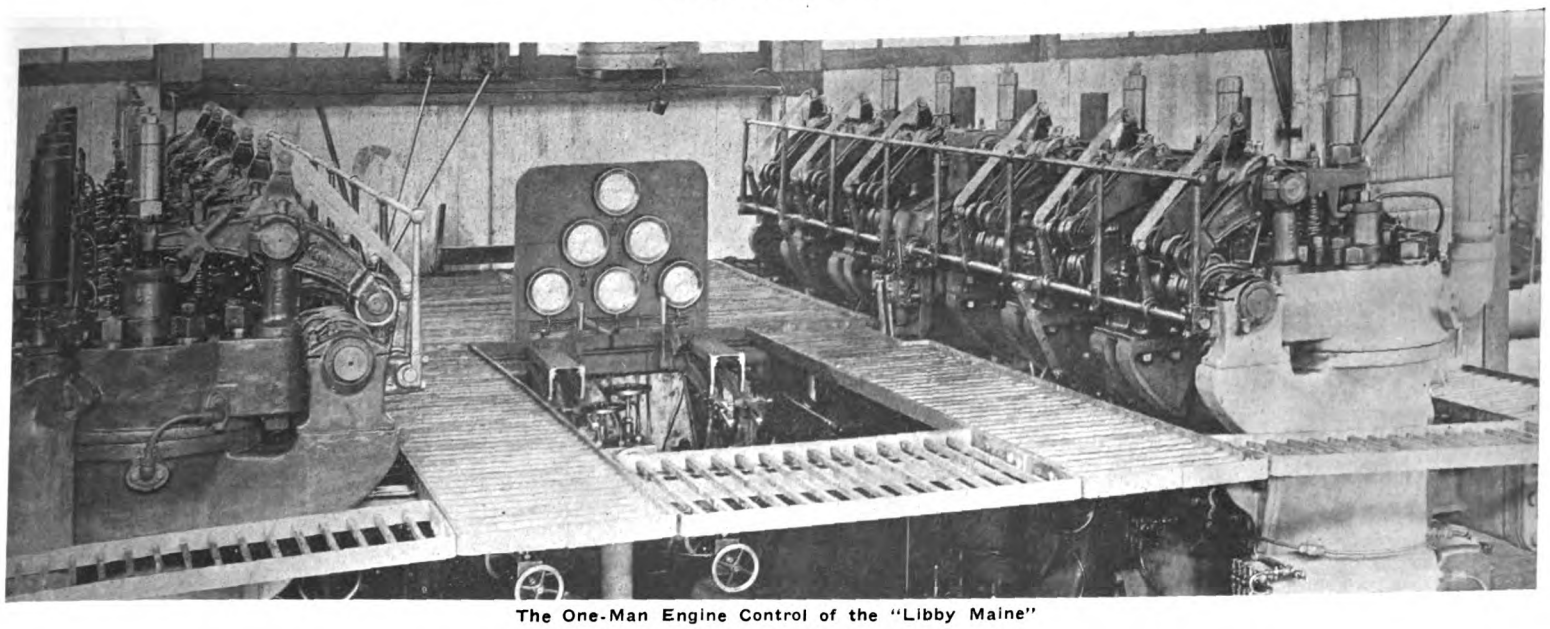


The One-Man Engine Control of the "Libby Maine"

Maiden Voyage of the "Libby Maine"

Installation of the First Pair of Dow-Willans Diesel Marine Engines

As much interest has been taken in the maiden voyage of the new full-powered motorship "Libby Maine" as in that of any vessel recently launched in the United States, since in this voyage the first practical demonstration was given under ordinary sea conditions of the Dow-Willans marine type Diesel engines, built by the Dow Pump & Diesel Engine Company of Alameda, Cal. This company (which holds the sole United States license for the construction of Diesel engines under the patents and designs of Willans & Robinson of Rugby, England), has for some years been building such engines for stationary use with very excellent results, but only comparatively recently developed the additional features to adapt them to marine use. If, as has been confidently expected, the marine type proves as successful as the stationary, the Dow plant is certain to be an important factor in American motorship development.

The initial voyage of the "Libby Maine" was too short to show conclusively what her motors will do under all the varying conditions of marine service, but the results as far as they go are highly satisfactory. The vessel is now bound for the Behring Sea, in the salmon cannery service for which she was designed, and if her power equipment continues to behave as well throughout the season in Alaska as on her first two days' trip, there need be no further hesitation in pronouncing it an unqualified success.

An account of the launching of the "Libby Maine," with a detailed description of her engines, was given in the April issue of "Motorship." She was built by the G. M. Standifer Construction Company of North Portland, Ore., for Libby, McNeill & Libby, whose auxiliary motorship "W. F. Burrows" was built last year by the same company. She is a wooden vessel, substantially built of Oregon fir, her design being such as to give maximum carrying capacity and seaworthiness. The engines are installed amidships, and are geared down from a normal engine speed of 250 r.p.m. to a propeller speed of 100 r.p.m. The propellers are of the 4-bladed built-up type, which, while not calculated to give the highest speed, are found most servicable under Behring Sea ice conditions.

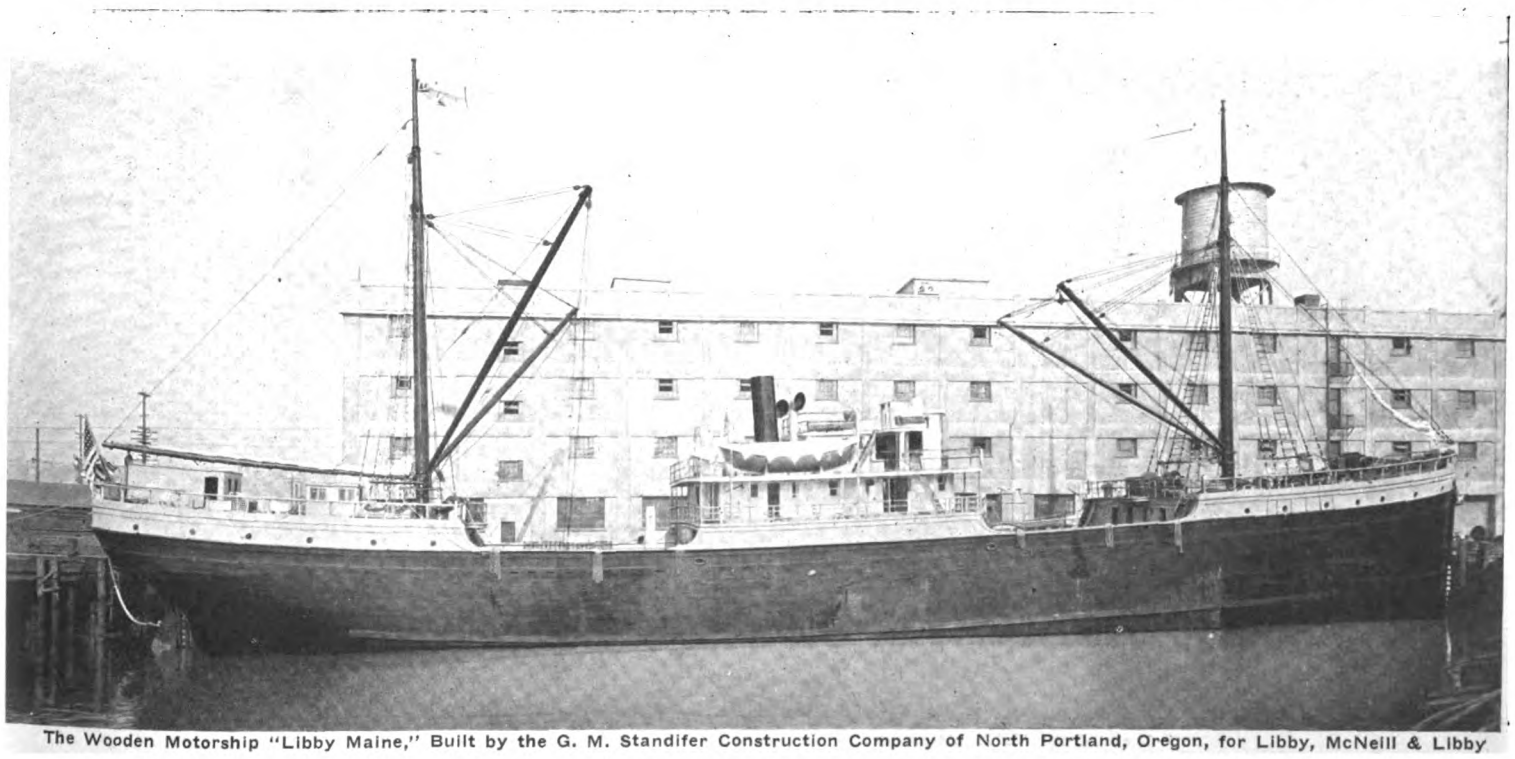
Her dimensions are as follows:

Length overall	240′
Breadth	43′
Moulded depth	24′
Dead-weight-capacity	2,000 tons
Engine speed	250 R.P.M.
Propeller speed	100 R.P.M.
Type of engine	Four-cycle Diesel
Reversing system	Direct-reversible
No. of cylinders per engine	6
Bore and stroke	12″ x 18″
Brake-horse-power per engine	320 H.P.
Indicated horse-power per engine	428 H.P.
Fuel consumption on trip	0.42 lbs. per B.H.P.

To our mind this is another instance where the power hardly is sufficient for a full-powered ship of this tonnage, whether steam or Diesel. It means that the machinery has to be kept running at its limit of power during all seagoing conditions. Whereas, in order to avoid undue strain, all ships' engineers invariably operate their engines at a little below the maximum power, reserving a few horse-power for times of emergency or necessity. In this case, if the engines stand up to the work of driving this big ship, as we feel they will, it will show the excellency of their design and construction.

The owners desired to get her into active service as quickly as possible, and as her engines, in a brief dock trial and a short run along the Portland waterfront, gave a most satisfactory performance, she was immediately accepted without a formal trial trip. The need for haste also prevented the keeping of very detailed records on the trip from Portland to Seattle, although such records are to be carefully kept on her first voyage to Alaska. The dock trial was made as soon as the installation of the main engines and auxiliary equipment was completed, and comprised a continuous run of twenty hours for the starboard engine and six hours for the port engine.

Before installation the engines each had been given a shop test of 72 hours' operation under full load. Soon after the dock trial the "Libby Maine" started on her trip from Portland, Ore., to Seattle, Wash., having practically no cargo aboard and drawing 16½ ft. of water aft and 14½ ft. forward. On this trip, in addition to her crew, she had aboard W. H. Rost, mechanical engineer, and Thos. G. Packham, secretary of the Dow, Pump & Diesel Engine Company. After a



The Wooden Motorship "Libby Maine," Built by the G. M. Standifer Construction Company of North Portland, Oregon, for Libby, McNeill & Libby

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quick run down the Columbia, a stop was made at Astoria to take on a pilot.

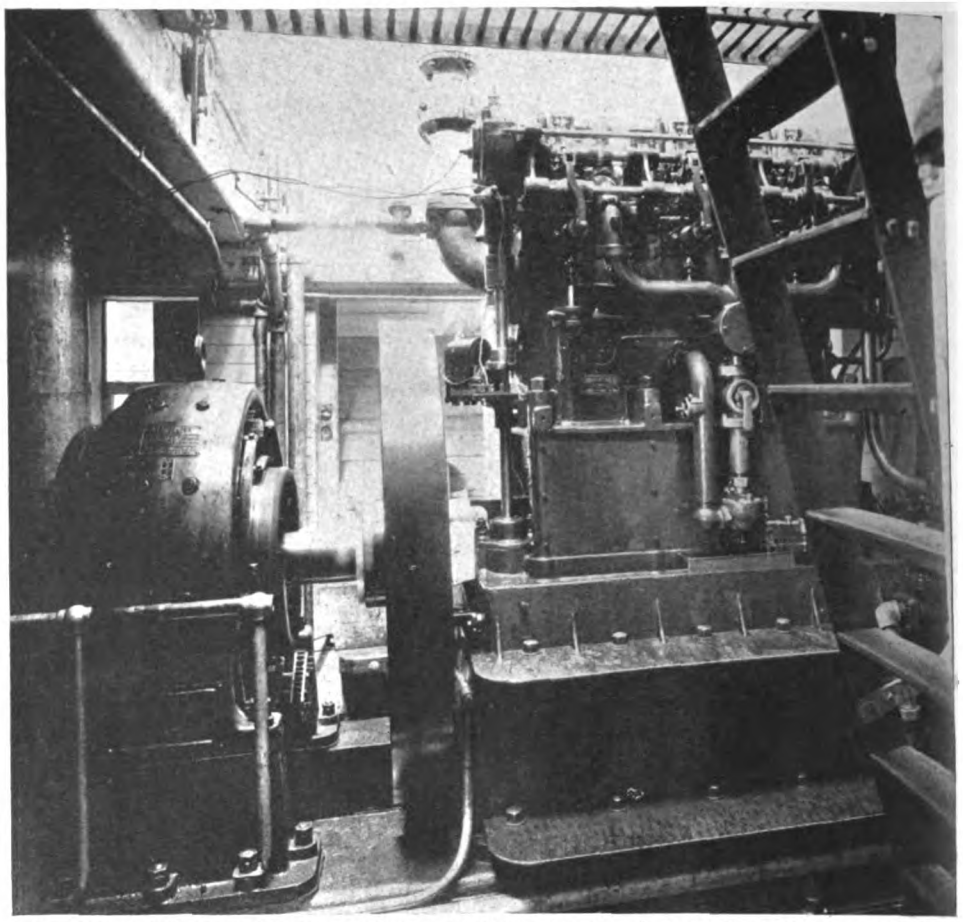
She left Astoria early on the morning of June 24, coming abreast of the Columbia River lightship at 6 a. m., and after crossing the bar she proceeded 13 miles to sea before heading north. From here on no stop was made until the vessel reached Seattle at 9.30 p. m., June 25. The engines ran smoothly and steadily throughout the entire trip, responding quickly and accurately to the control mechanism on all speeds, both ahead and astern; and a notable feature, both of this trip and of her later movements in Puget Sound was the almost complete absence of smoke or visible vapor in the exhaust. The weather was fair with a very light northerly head wind, so that no test could be given of her behavior in a sea.

It was deemed inexpedient to run her engines up to the normal number of revolutions at the start, as it was found after she had been under way a short time that some friction (due presumably to a slight inaccuracy in mounting the tubes) developed in the stern tube bearings. Until Cape Flattery was passed the engines were accordingly operated at 220 r.p.m.; but as the friction had gradually disappeared the speed was gradually increased to 240 r.p.m. on the run up the straits. The average speed for the entire trip was about 7 knots, the slow time being due largely to the fact that the engines were held below their normal speed, and partly also to the construction of the vessel, which was built for strength and carrying capacity and is said to have been first laid down for a sailing vessel, with a large projecting keel which tended to retard her movement. Both the engineer and the captain express the belief that at normal engine speed she will be able to make 8 knots or better.

The following notes from the log of the "Libby Maine" are of some interest as showing the vessel's performance at sea:

Came abeam lightship Columbia River June 24, 6 a. m.
Went 13 miles west, set course for Cape Flattery, a distance of 151 nautical miles.
Passed Cape Flattery, June 25, 3.40 a. m.
Time for this leg of voyage, 23 hours.
Average speed, 7 knots.
Engine speed, 220 r.p.m.
Arrived at Seattle, fast at dock, June 25, 9.30 p. m.
Engine speed, Flattery to Seattle, 240 r.p.m.
Average fuel consumption for the trip, .42 lbs. per b.h.p. hour.

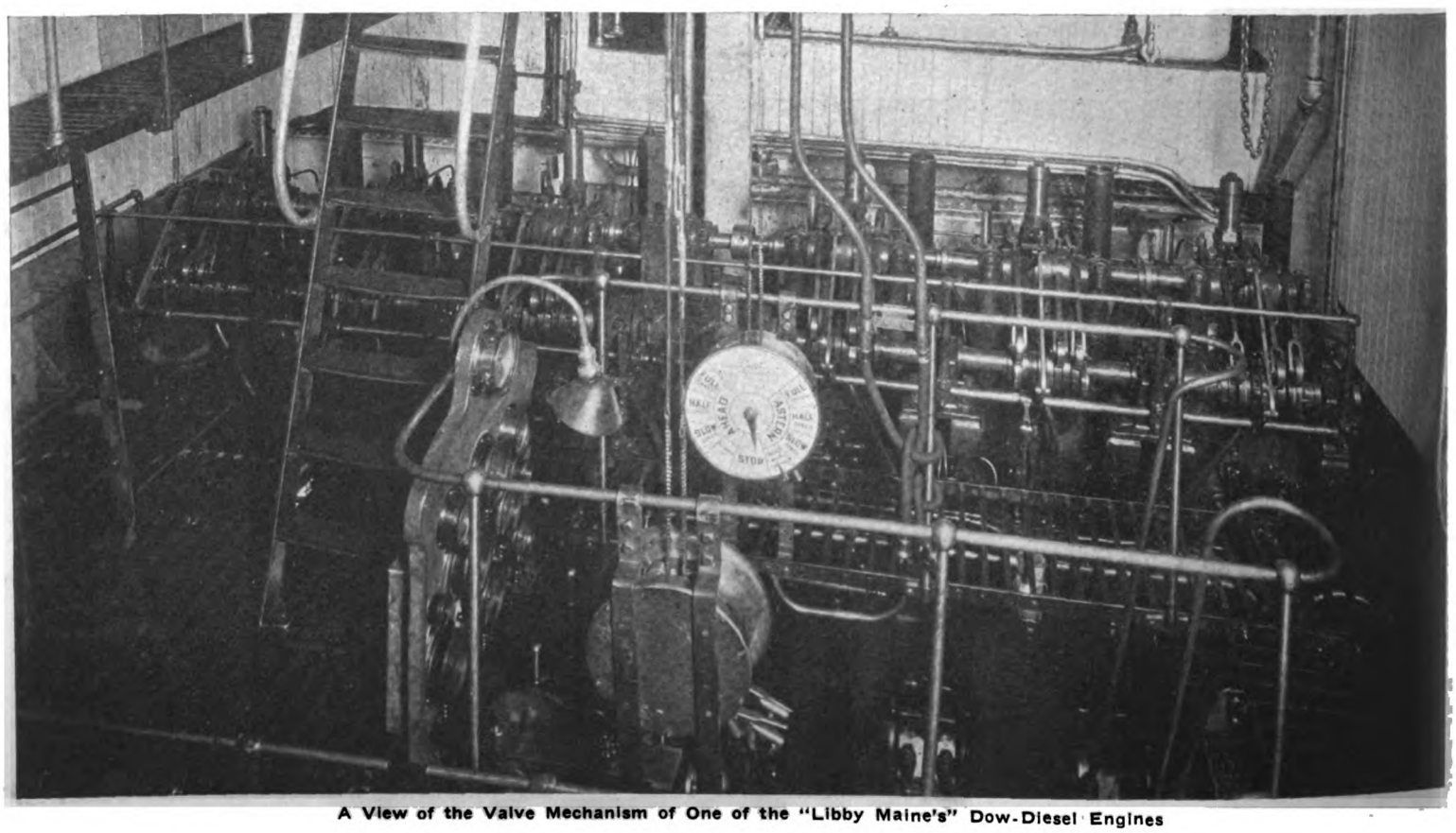
Capt. Herre, the master of the vessel, and her engine-room crew, are very well pleased with the way she handles and the ease with which the engines are controlled. The common impression has been that extensive Diesel engine experience was necessary for men handling Diesel-engined vessels; but Capt. Herre's former experience has been limited to steam vessels, while the chief engineer had spent about two months in the shop during the construction of the engine, and the other members of his crew had had no previous experience with engines of this type. In moving along the Portland waterfront and along the Willamette and Columbia the "Libby Maine" handled very easily, making short turns and quick starts and stops without difficulty, and was able to turn completely around in little more than her own length. The landing at Astoria was made without lights, but she came up to the dock accurately and without trouble of any kind.



The 80 h.p. 'Frisco.—Standard Auxiliary Distillate Engine and the 125 Volt General Electric Motor, Which Furnishes Power for the Auxiliary Machinery of the "Libby Maine."

The accompanying photographs give a good idea of the "Libby Maine's" appearance, as well as of her engine installation. Especially interesting is the view of the main engines, looking forward, showing the arrangement of a central system for a one-man control, a novel feature for a vessel of this size. Such an arrangement was deemed advisable in the first place owing to the high keelson between the main engines, as their control by separate systems would have been awkward on this account. The operating station was located therefore directly on top of the keelson between the engines, all gauges indicating air-pressure, circulating water, fuel oil pressure, etc., being set on one board before the operator, with the telegraphs just above the level of his head on either side, and the levers and quadrants for controlling the port and starboard engines conveniently located at either hand.

A feature of these engines is that in reversing or starting it is not necessary to open any valves, all operations being controlled by the movement of the two levers for each engine. It will also be noted that located in front of the operating station, just beneath the gauge board, is the manifold valve body, for controlling the movement of air from the compressors to the injection and starting air bottles. Bottles for fuel-injection air are seen on either side of the keelson in front of the operating station, so that all vital mechanism for controlling the engines is right at hand, and has been found by experience to be most conveniently operated by one man, although the station gives ample room for two men if desired.



A View of the Valve Mechanism of One of the "Libby Maine's" Dow-Diesel Engines

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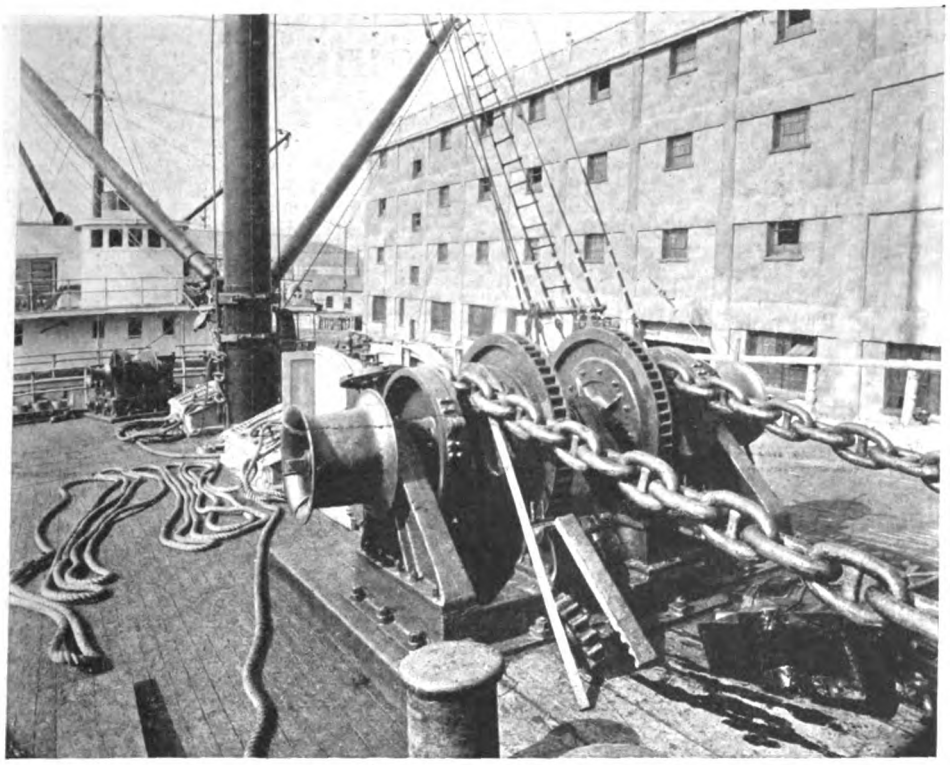


One of the Electrical Deck Auxiliaries of the "Libby Maine,"—the Anchor Windlass!

Regarding the one-man control idea at first, the engineer pronounced the arrangement a decided success. The bottles for starting air are located between the deck beams in the after part of the engine-room.

The air-compressors are of the well-known Reavall type, which is well known among both American and European Diesel engine builders. They are of the three-stage type, with cylinders and inter-coolers entirely immersed in water, and are driven off the forward end of the engine crankshafts. There also is an auxiliary Reavall compressor located between decks and driven by a 2-cylinder 30 h.p. Frisco Standard distillate engine. Bilge and fire pumps of the three-plunger type are also arranged to be belt-driven from this engine. In the 'tween-deck section also is the 5 h.p. Frisco Standard distillate engine with a generator for the radio outfit.

Electricity for lighting and for the operation of the deck machinery is furnished by a 125-volt General Electric generator, direct connected with a 3-cylinder 80 h.p. Frisco Standard distillate engine, located above the engine-room on a level with the main deck. The deck machinery is all electrically driven, and was built by the Pacific Machine Shop & Manufacturing Company of Seattle, Wash. It includes a powerful anchor windlass and two cargo hoists abaft the after hoists on the forecastle head, and two cargo hoists abaft the after hold. This type of deck machinery has proved efficient on a large number of motorships.

The full crew of the "Libby Maine," including the master, number 18 men; the engine-room crew consisting of three engineers, three oilers, and a wiper. The boat has very comfortable accommodations, having six large staterooms besides the officers' quarters. These together with the dining saloon are located on an upper deck amidships, over the engine-room, the galley and crew's dining room being forward of the engine-room on the main deck. The staterooms are supplied with hot and cold water, with private baths, and are lighted and warmed by electricity; and the interior is finished in white enamel and mahogany. The bridge and main pilot-house are placed above the staterooms amidships.

A large forecastle in the bow provides accommodations for the ship's crew, and also contains some space for Oriental cannery help. Considerable space has been provided under the poop deck aft for white cannery employees, although this is being used for cargo on this trip.

While the vessel has not yet been tried in stormy weather, Mr. Rost, representing the engine builders on her first Alaska trip, is confident that the varying strains on the engine will easily be handled by the governor, which is of the Dow improved centrifugal type, operating directly on the supply of fuel oil to the injection valves in proportion to the load, at all times maintaining the predetermined r.p.m. This governor has for some years proved highly efficient in taking care of extreme and abrupt changes of load on the engine used as motive power in the Dow shops, and it is felt that the tests already encountered in this respect are fully as severe as anything that will be found in marine service. After the return of the "Libby Maine" from Alaska, it is expected that a complete and detailed account of the performance of the engines will be available for publication in "Motorshop."

[Just as we close down for press, word has reached us that the "Libby Maine" has arrived at her destination, namely—Libbyville, Bristol Bay, Alaska, after a thoroughly satisfactory voyage, the distance being 2067 nautical miles. No trouble of any kind was experienced with her Diesel engines, which fact speakes for itself.—Editor.]

SAILER CONVERTED TO MOTOR TANKER

It is reported that the steel bark "Dolbadarn Castle," of 1989 tons gross register, has been converted into a motor tank-ship, and that Diesel oil engines of the Werkspoor design have been installed.

HULK CONVERTED TO MOTORSHIP

The ancient Argentine hulk "Kent," 700 tons register, which had hitherto been used as a floating workshop, says "Syren & Shipping," has now been converted into a motorship at the yards of Ballesti and Gonzalez in the Riachuelo. She had been purchased by Messrs. Dodero Brothers, who resold her to the French Government.

STANDARDIZED 2,500 TON MOTORSHIPS

The first of the standardized Siemans-Martin steel-built motorships completed at the Finnboda yard, Sweden, has been purchased by the Svea Company. Two 650 b.h.p. two-cycle type Diesel engines are installed.

ACME ENGINE CO. AND W. S. S.

Every officer and employee of the Acme Engine Co., of San Francisco, has pledged himself to the cause of the War Saving Stamp campaign. They already have purchased or pledged themselves to stamps up to the value of $2,000.00.

MORE PACIFIC COAST MOTOR AUXILIARY SHIPS

The auxiliary schooner "Samuel H. Hedges," which was launched from the yards of the Puget Sound Bridge and Dredging Co., West Seattle, has been equipped with two 350-horsepower Skandia oil-engines. The auxiliary schooner "Fanestrand," which loaded last month on Puget Sound for the Orient, was powered with two 350-horsepower Skandia oil-engines.

SPANISH-BUILT MOTOR AUXILIARIES

At Mallorca, Spain, there are under construction eight wooden motor-auxiliary sailing ships of 150 to 500 tons dwc. One yard, however, will shortly lay down a four-masted vessel of 1,000 tons displacement. Her length will be 160 feet by 35 feet beam and 15 feet depth. At Pollensa, a 280-ton vessel is now building.

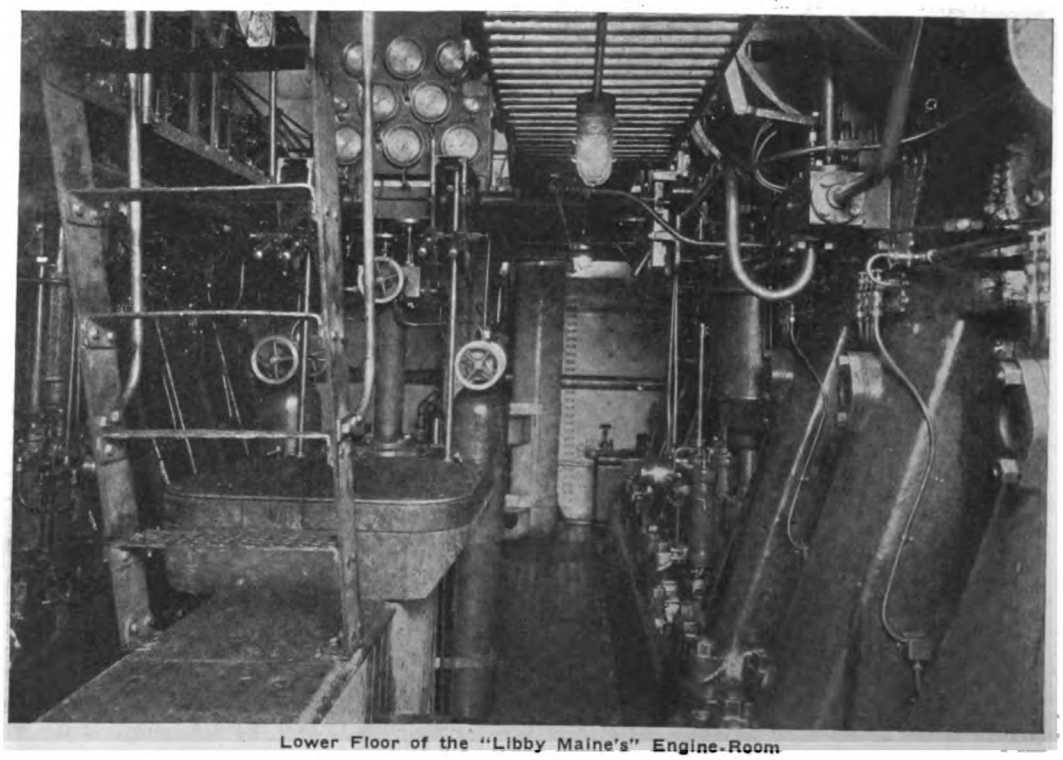
TOTAL AMERICAN SHIPS SUNK AND BUILT

According to Secretary of the Navy Josephus Daniels, the total American tonnage sunk during the whole period of the war up to July last was 352,223, of which 67,815 tons was sunk prior to America's entry into the great conflict. However, as we took over 650,000 tons of German ships, the laugh is still with Uncle Sam, as we are over a quarter of a million tons to the good.

Altogether the total number of new merchant ships completed and delivered since the U. S. Emergency Fleet Corporation took over control of shipbuilding in America is 218 vessels of 1,384,428 tons d.w.c. However, we must not for a moment cease in our efforts to rapidly produce vast numbers of new merchant and naval vessels, particularly merchant motorships.

THE JACOBSON MARINE WINCH

Referring to the Jacobson standard types of heavy-oil engine marine winches or hoists, we have been advised that the makers, the Jacobson Engineering Company of Saratoga Springs, N. Y. are in good position to supply them, equipped with both their horizontal and vertical crude-oil engines, in all sizes from five horsepower and upwards. The larger units can be built up especially to suit each individual case, and can be used in dredges, or on shovels, for heavy work in place of ordinary steam engines, and in capacities up to several hundred horsepower per unit. In this connection it is of interest to mention that this company now have under construction two new machine and erecting shops, which are especially designed for handling heavy hoisting engines and marine oil engines, as well as stationary engines for every purpose.



Lower Floor of the "Libby Maine's" Engine-Room

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Possibilities of the Hvid Engine

By E. B. BLAKELY

APPARENTLY the greatest problem before automotive engineers at present is, how to substitute cheaper oils for gasoline as fuel in at least four distinct fields, namely: The motor-boat, truck, tractor and stationary farm engine fields.

The development of appliances for using kerosene in internal-combustion motors has been very slow; indeed, there is not on the market today a device for burning kerosene in a standard gasoline motor which is entirely satisfactory. The reason for this is that it has been known for years that almost any gasoline motor when once hot will run after a fashion on kerosene, and the knowledge of this fact has proved a serious handicap to many engineers, for it has led them to work along the conventional lines, which have proved satisfactory for carbureting gasoline without giving much thought to the fact that kerosene and gasoline are widely different substances, having nothing in common except that they are derived from the same base. They are chemically very different, their initial boiling points are wide apart (that of good gasoline being about 68 Deg. Fahr., that of kerosene about 338 Deg. Fahr.); their boiling range is totally different (that of gasoline being 344 Deg. Fahr., while that of kerosene is 206 Deg. Fahr.). Gasoline mixtures ignite spontaneously at approximately 680 Deg. Fahr., while like mixtures of kerosene self ignite at approximately 575 Deg. Fahr. A permanent fixed gas can be made by mixing good gasoline and air without the use of heat; with kerosene this is impossible.

If you were asked what you would regard as absolutely satisfactory in the way of a kerosene motor, I think your answer would be somewhat as follows: First, the motor must start cold on kerosene without any delay or preheating; second, it must burn the fuel completely, leaving no smoky exhaust; third, the fuel economy must be as good as in the best gasoline motor, better if possible; and fourth, there must be no carbon deposits to foul spark plugs or cause pre-ignition, and if you are an engineer you will add a fifth clause—it must follow closely accepted standards of design.

It sounds like a big order, but it can be filled easier than you think. There are right now being built by several manufacturing concerns many large, heavy duty motors of both single and multi-cylinder type which fulfill all the requirements cited above, and which operate on a sound principle discovered, developed and patented by R. M. Hvid, a naturalized American-Danish engineer.

[The Hvid-Brons principle was described in "Motorship" for July.—Editor.]

Let us examine Hvid's principle and see how its adoption would affect present standard and accepted designs. In the first place, a Hvid type motor is a straight four-cycle motor of conventional design, preferably of the overhead valve type, weighing about 10 per cent more than gasoline motors of the same rated horsepower. Ignition is secured by the heat of compression as in Diesel motors. For kerosene 390 pounds per square inch is used; for heavier oils up to 450 pounds is used. There is no complicated air compressor with its attendant piping necessary, as in the Diesel engine, fuel economy is on a par with Diesel practice.

A study of the results obtained from two dynamometer test runs recently made at Armour Institute under the supervision of Prof. Daniel Roesch of 5¾ by 9 single cylinder Hvid type engine, will, no doubt, be of interest as showing the various characteristics of the Hvid principle or cycle.

The engine was operated under various loads and speeds with various adjustments of fuel supply, compression and cup design. The final setting was made with 390 lbs. per square inch compression.

Test runs were conducted at various loads from a maximum to about one-eight of maximum load, and readings were taken to determine the following:

(1) Friction horse power (electric dynamometer method).
(2) Brake horsepower (torque and speed).
(3) Jacket water loss.
(4) Sensible heating in the exhaust.
(5) Loss due to radiation and incomplete combustion (by difference).
(6) Fuel consumption (pounds per hour).

Items 1 and 2 are determined directly from dynamometer readings.

Items 3 and 4 are calculated from observed temperatures and weights.

Item 5 is determined by difference.

Item 6 is obtained from direct measurements.

The heat value of the fuel expressed in "B. T. U." per pound of kerosene is calculated from the following accepted formula:

B. T. U. = 18,440 40 (deg. Baume — 10)
= 19,740 for the quality of fuel used in these tests.

The observed and calculated data are given in the accompanying charts.

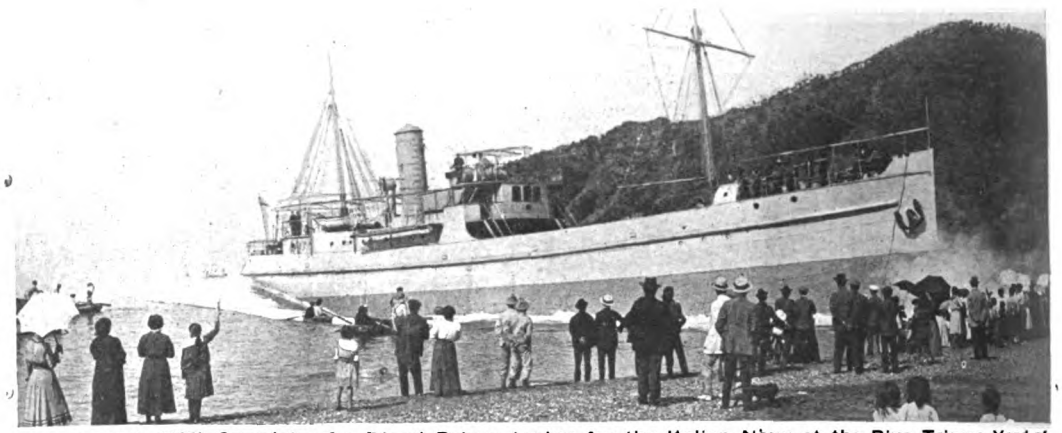
The first test runs indicated that stratification of the fuel was taking place in the combustion chamber and that when the engine was pulling its normal load, 44 per cent of the fuel was being lost through radiation and incomplete combustion, and when an overload of 15 per cent was put on the engine as high as 55 per cent of the fuel was lost in the same manner. The engine, however, ran smoothly, developed all the power expected of it and showed rather wonderful torque characteristics. After the first run was completed the valve timing of the engine was slightly changed and the shape of the combustion space altered, so as to secure a better diffusion of fuel through the highly compressed air and a second test run was made. The results obtained on the second test showed a very marked improvement over the ones obtained on the first. One of the most important improvements was that of fuel consumption. At approximately a normal load, only 28 per cent of the fuel was lost in radiation and incomplete combustion, against 44 per cent on the first test. At a 15 per cent overload, only 33 per cent was lost against 55 per cent on the first test. This was quite an appreciable change.

On the first test the lowest fuel consumption was 0.666 lbs. per b. h. p. hr., while on the second test for practically the same load, consumption dropped to 0.526 lbs. per b. h. p. per hour. This is rather remarkable fuel economy for a small unit.

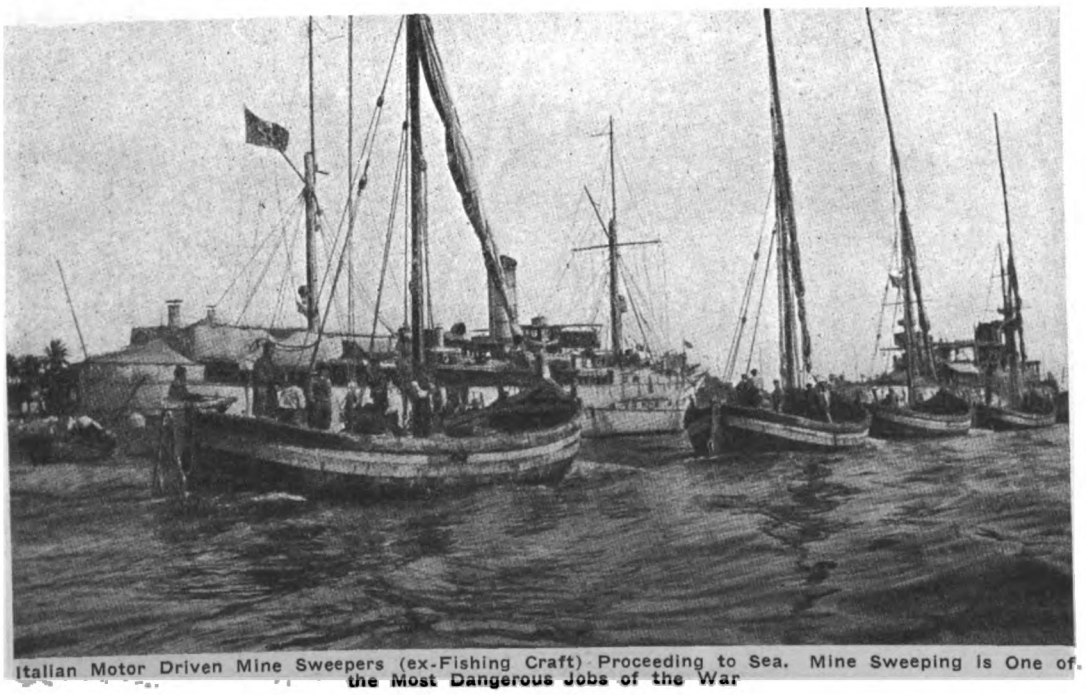
During the first test, the highest indicated thermal efficiency was 30 per cent at 3 h. p. and the highest brake thermal efficiency was 20 per cent at 5 h. p. On the second test the indicated thermal efficiency ran slightly over 32 per cent and the brake thermal efficiency went to 25 per cent, both at the rated power output of the engine (7 h. p). In other words, on the second test the highest thermal efficiency both indicated and brake was shown at the normal or rated power output of the engine, where they belong.

The test for torque was made by putting an arbitrary load on the engine and letting it run as fast as it would with this load and then increasing the load and observing the drop in r. p. m., the brake h. p., and the m. e. p. net. At the start the load was 80 lbs. on a 15¾-in. radius, and the r. p. m. was 431, showing a b. h. p. of 8.62 and a net m. e. p. of 68 lbs. The load was increased by easy stages to 100 lbs., at which point the r. p. m. had dropped to 272 r. p. m., but the b. h. p. at this speed was still 6.80 and the net m. e. p. was 85 lbs. To put it in percentages the r. p. m. dropped 37 per cent, but the brake m. e. p. increased 25 per cent so that the drop in b. h. p. was only 20 per cent. The minimum test speed was not the minimum speed at which the engine would funtcion well, but the limitation of low speed operation was reached because of excessive cyclical variation in speed which prevent authentic readings of torque.

I do not consider that the Hvid type motor has by any means reached an ultimate stage of development but the results obtained up to the present time both in single and multi-cylinder types have been so practical and satisfactory that I believe it is the duty of all progressive engineers to study this principle carefully.



Launch 100% Complete of a Diesel-Driven tanker for the Italian Navy at the Riva Trigoso Yard of the Societa Escercizio Bacini, Genoa. Altogether They Have Built Five of These Motorvessels, Namely, "ACHERONTE," "FLEGETONTE," "COCITO," "LETE" and "STIGE." These Vessels Are of 1,204 Tons, and Each Are Driven by One 400 to 500 b.h.p. Diesel Engine. Three Have Tosi Engines and Two Have Fiat-San Giorgio (Now Ansaldo-San Giorgio, Ltd.) Engines Installed.



Italian Motor Driven Mine Sweepers (ex-Fishing Craft) Proceeding to Sea. Mine Sweeping Is One of the Most Dangerous Jobs of the War

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Hvid's principle is so simple as to be almost elementary, and not only will it permit the burning of kerosene and other heavier hydro-carbons, with very high economy, but it does away entirely with all ignition and carburetor devices.

The writer does not intend to belittle the efforts of those engineers who have devoted time, energy and money to the kerosene carbureter problem, for they deserve great credit. Particularly is this true of the carburetor manufacturers who have had to bear the brunt of it, but it really looks as if they have been following a "Will O' the Wisp," in their efforts to burn kerosene by essentially the same mechanical means as gasoline.

Here, then, is a principle, which, instead of requiring a lot of complications in order to burn kerosene, actually does away with all the complications of ignition systems (the cause of about 85 per cent of all motor troubles) and all intake manifolds and carburetors. Not only will a motor built on this principle burn kerosene perfectly, but also other heavier and cheaper distillates within quite a wide range, without any adjustment and its fuel economy, volume for volume, is nearly twice as great as that of the best gasoline motor. Its torque characteristics more nearly approach those of a steam engine (maximum torque at zero r. p. m.) than do those of any other internal combustion engine yet made.

The disadvantage of the increase in weight of the Hvid motor over gasoline motors of equal power, is negligible when compared to the many advantages gained and complications removed. The fuel situation is rapidly becoming such that the problem of burning kerosene in internal combustion motors will not be the only problem, there will also be the problem of burning cheaper and heavier fuels in classes of motors which are today burning gasoline.

Read before the Mid-West Section of the Society of Automotive Engineers, at Chicago, Ill.

[The Hvid principle is worthy of careful study not only by automotive engineers, but also by designers of large marine engines. It has been built in 75 h. p. cylinders in this country and larger in Europe and it may turn out to be more simple and effective in the larger sizes. It is not a "Diesel" nor a "semi-Diesel." For those not familiar with the Hvid principal the description "high-compression oil-engine" should be used, but all must recognize that Hvid engines, as manufactured by numerous licensees constitute a distinctive class in the family of oil engines—Editor.]

AMERICAN AND BRITISH NAVIES

There have been added to the U. S. Navy no fewer than 1,275 craft aggregating 1,055,116 tons. They are manned by about 300,000 officers and men, and these soon will be increased to 400,000. In the British Navy there now are 3,500 warships and 150,000 men.

Our Reader's Opinions

AUXILIARY MACHINERY OF MOTORSHIPS

To the Editor of "Motorship."

Sir:

The large employment of Diesel engines in the construction of new ships would, I believe, justify a study regarding the problem of auxiliary engines (steering gear—windlass-winches—hoists—pumps—lighting and heating) for these motorships.

While a large percentage of these auxiliary engines are steam-driven by an independent boiler, the electric drive with power furnished by an independent gas engine, as well as other systems, are employed.

Probably each type has certain advantages and maybe the advantages are compensated; but, we believe that when the motorships will be built in large quantities one system will be adopted as the best.

It would be interesting to have the opinion of your good selves, as well as that of the readers of your magazine, on the subject, in order to solve the problem once forever, and to avoid that everyone building of motorships have to study the question from the beginning with the possibility of reaching the wrong conclusions.

Hoping that you will not find our suggestion a useless one, we remain,

Yours very truly,

July 12, 1918. GIO-ANSALDO & CO.

[While steam generated by waste exhaust gases from the main Diesel engines is the most economical system, we think that other advantages of electrical auxiliaries will cause the latter to be generally adopted—at least, until some new development takes place. What do our readers think?—Editor.]

THE "STARLITE'S" PROPELLER

To the Editor of Motorship:

In your article, "Motorships in Operation," series 3, January number, written by the editor, speaking of motorship "Starlite," you give the dimensions of the propeller as follows: 78.74" pitch, 55.12" diameter, with 17.76 square feet area.

I wonder if this should not read 78.74" diameter, and 55.12" pitch. You did not state the r. p. m., but I presume it is around 250.

The writer is particularly interested because he is acting as Naval Architect for the Pan-American Trading Co., of Houston, Texas, who are building a reinforced-concrete tanker of 1300 d. w. c., equipped with a 300 b. h. p. Diesel motor, turning 250 r. p. m., the speed of the ship to be 7½ to 8 knots.

Preliminary computations gave the required diameter as 72 to 78", the area about 16 to 17 square feet, and the pitch as 4½ feet, with an apparent slip of 25 per cent. This indicates that your information would coincide with my computations, if your information on the propeller diameter and pitch is reversed.

Thanking you in advance for your prompt attention, I am,

Very truly yours,

M. H. PAGENHARDT.

[It since has been decided to install 500 b.h.p. in the above ship.—Editor.]

VOYAGES OF THE MOTORSHIP "CITY OF PORTLAND"

To the Editor of "Motorship."

I have been a constant reader of "Motorship" since March, 1917, when I first got into the crude-oil engine game and have read many interesting and educating articles in same.

My first experience with crude oil-engines was as first assistant on the ship "S. I. Allard," from Columbia River via Honolulu to Sydney, Australia, and return to Columbia River via the Tonga Islands, and we had such good success. I made up my mind to stay with oil engines, having been with steam fourteen years.

Came on this ship as chief last November, in San Francisco, where some alterations were being made. Took a cargo to the Sound and loaded a cargo of ship timbers there for this coast. From San Francisco to Balboa, C. Z., 3245 miles, we averaged 7.74 miles per hour.

Had about 3 days of fair wind which added about 10 miles to our average run on these 3 days.

Laid overnight in Balboa (no work had to be done on engines). Went through the canal without a bit of trouble. Laid in Colon that night and next morning left for Portland, Me., 2446 miles at 7.24 miles per hour. Was slowed down one night on account of fog.

From Portland, Me., to Savannah, Ga., 1055 miles average speed, 9.43 miles per hour. Here we were flying light and had a good, fresh wind on our quarter for about 2½ days. Engines running continually.

From Savannah, Ga., to New York, 700 miles average speed, 7.26.

From March 13th, when we left San Francisco to present date, have not spent a 5-cent piece for repairs and she is ready to duplicate the trip, which is a credit to the assistant engineers who kept their eyes open all the time looking for trouble. Results being they had none.

One interesting feature of the trip is that of not being worried about fuel. Had 1606 barrels leaving San Francisco and after discharging 2 cargoes and loading one had enough fuel left to make a run of 2,000 miles more.

Yours very truly,

C. HUGO HANSON,
Chief Engineer.

M. S. "City of Portland"
At New York, June 14th, 1918.

THE VALUE OF MOTORSHIP

Montreal, March 27, 1918.

To the Editor of "Motorship," Seattle, U. S. A.:

Sir:—We have just received a copy of the March issue of "Motorship," and wish to compliment you. This is certainly the finest issue you have ever gotten out. The one article comparing two and four-cycle Diesel engines is worth many times the price of your magazine for, a whole year's subscription, and is undoubtedly the most comprehensive ever written on this subject.

We wish you would send us by mail immediately half a dozen copies of this issue, as we want these for our office and outside salesmen.

The Diesel engine is coming into its own very fast in Canada, and in the near future we will carry an ad. in your magazine.

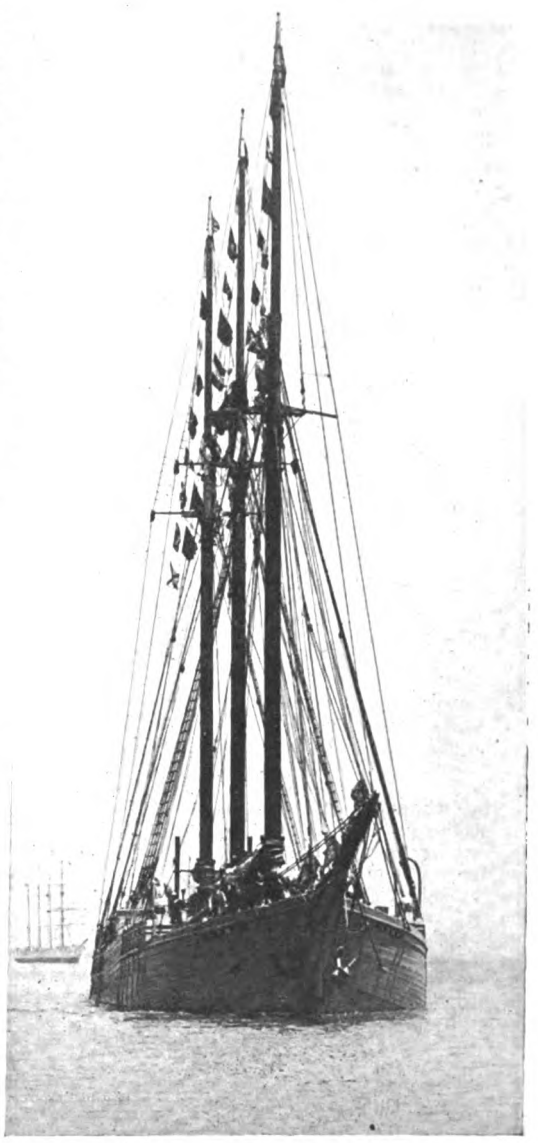
As soon as we commence installing Diesel engines we will send you photographs and full particulars of each, and wishing you every continued success, remain, A. J. A. PYKE.

DENMARK HAS NEARLY 500 MOTORSHIPS

There were four hundred and eighty-eight motorships aggregating 97,316 gross tons (about 180,000 tons d. w. c.) in the Danish mercantile fleet on January 1, 1918, according to Commercial Agent Norman L. Anderson. He says, 55 vessels of 80,200 gross tons have Copenhagen as their port of registry. This compares with 464 motorships of 95,024 gross tons on January 1, 1917.

Obviously, 433 of these craft must be fishing boats, tugs, and other small commercial craft, as their average dead-weight capacity is only about 70 tons. However, 55 motorships averaging about 2,750 tons d. w. c. each in addition, is no mean "little fleet," for such a small country. On January 1st, of this year, Denmark had 538 steam-driven ships of 577,882 gross tons aggregate.

We do not know if Mr. Anderson's figures are officially accurate, but we are very much inclined to think that they can be relied upon as the East Asiatic company of Copenhagen owns 15 motorships of 120,000 total tons capacity.



The Auxiliary Motorship "Ozmo," Formerly the "Hugh Hogan." She is Driven by Two 160 b.h.p. Bolinders Oil Engines. Built Originally for a Lumber Schooner and Later Double Decked, Now Operated by Geo. McNear in Case Oil Trade Between San Francisco and New Zealand.

DOMESTIC PRODUCED OIL IN SWEDEN

The new Swedish State Oil Co., which as a maximum capital of sixteen million kroners, is producing oil from shale, of which there are large deposits in that country. Only about 14 to 21 barrels per day is expected at this time; but in about two years this will be increased to nearly 200 barrels per day.

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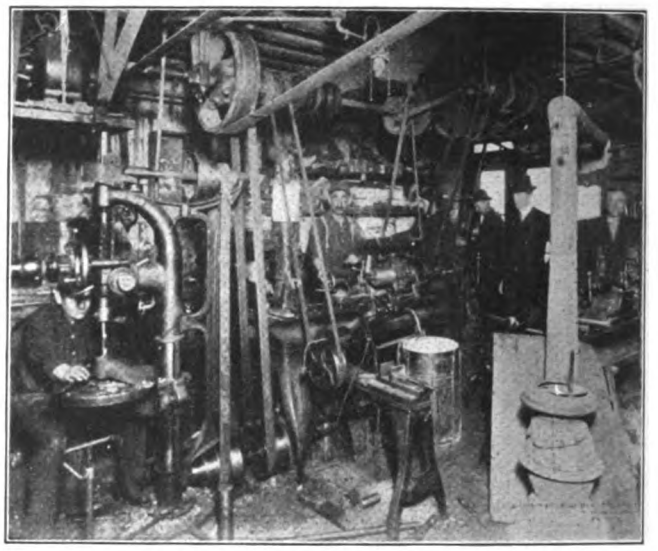
Rebuilding Marine Engines

ONE of the most interesting engineering industries in connection with commercial motorcraft is the work of rebuilding used engines, and in several instances this is quite a serious work, quite distinct from anything relating to "junk shops." For instance, often an engine is purchased by a work-boat owner and installed in a vessel for which it is entirely unsuited. Naturally it fails to stand-up to its job, and hot bearings, or other troubles and breakdowns occur, and the owner in disgust takes the motor out of his craft and "trades-it-in" for a new engine, or else sells it for what he can get. Such an engine can be rebuilt, and when installed in a type of boat for which it is designed and suited, results in a power plant as good as a new equipment. Of course, some engines may need far more re-constructing than the case just referred to.

Such a business might be termed an "engine hospital." Of the leading companies engaged in this class of work one of the best known are Bruns Kimball & Co., Liberty Street, New York City, who have handled and rebuilt thousands of marine internal-combustion engines.

There hardly is a month in the year when the stock in this motor hospital is below two hundred machines and often it runs over this. As these machines are all rebuilt in the firm's own shops it will be of interest to learn some of the peculiar problems confronting the mechanics in overhauling and rebuilding these machines.

Rebuilding Engines at One of the Bruns Kimball Works



A Corner of Another of Bruns Kimball's Machine Shops

In order definitely to fix responsibility and to secure a complete and accurate record of each rebuilt machine, each one is recorded on a special card. The motors are secured from customers for new motors, being taken in part payment for new ones.

As soon as the motor has been described and examined, it is given a number, the horsepower, make and other data are recorded and the name and address of the owner from whom it is secured. The salesbook page, which gives complete record of his transaction, is also noted on the card. A list of the equipment is then noted. As soon as this motor is received, it is carefully examined and investigation made concerning any parts that are in bad order and concerning any items that are short or lost. At the bottom of the card is space for the name and address of the person purchasing this motor, with date and salesbook page. On the reverse side of the card is a "record of transfer," in case where the motor may be again traded in after a term of years or—in rare cases—sent back because of non-satisfaction. Following this, there is a space provided for a complete cost record, but as this space is often too small for completing this record, a supplemental ticket is supplied to carry forward and complete this cost record. Every man who works on the job will be recorded on the cost side of the card and all materials used will also be recorded and the card must finally be O. K.'d by the foreman, showing that the motor has passed inspection before being shipped, giving a complete record of just what has been done—just who did the work and just what new parts were supplied on every motor rebuilt in their shops. This is a great help in adjusting any complaints which may arise as it fixes responsibility in the workshops and shows just what has been done.

It may be of interest to follow one motor through the shops to see how this system works out in practice and for this purpose we will take the rebuilding of a four-cylinder four-cycle motor known as the Beyster-Detroit. This motor was built for marine use and apparently was all right. Upon taking it down for overhauling it was found that the lubrication was entirely by splash, and, although there were four cylinders, there was only one oil partiton in the crank-case and there was no method for carrying the oil from the lower end of the crank-case to the upper or forward end of the motor. This problem was solved by the fitting of sheet brass oil partitions dividing the crank-case into four compartments and maintaining oil at the right level for the connecting-rod scoop to strike the oil on the down stroke. An oil pump was then provided attached to the camshaft and with its suction-pipe connecting to the lower end of the crank-case and provided with a wire gauze strainer. A discharge-pipe carrying the oil to the front of the motor, and with small jet nozzles to provide a spray for each connecting rod in addition, provided a satisfactory oiling system. This system was completed by a little gauge showing the amount of oil in the reservoir at the back of the crank-case.

Another tough job was a four-cylinder four-cycle motor built in Europe. This was a very high-grade and well-made motor, but had seen some hard use and required very thorough overhauling; in fact, the overhauling cost nearly $150. As the motor was built in Europe, and as immediate delivery was desired, it was not possible to send to Europe for repair parts, and it was therefore necessary to make such parts as were needed in the company's own machine shops. Here another problem was encountered, as these parts were all made to metric dimensions which did not work out especially well on standard American lathes. New push-rods were found to be necessary; also new push-rod guides. A pattern was made for the guides and the whole eight were cast from bronze and accurately machined and finished. The push-rods were made from steel and counter-turned at the upper end, so as not to carry oil from the base over the top of the guide and thus make a dirty engine-room. The push-rods were also provided with modern adjustments in place of the old-style thimbles on the old push-rods. The valves were slightly worn on the stems and the valve-guides were badly worn.

This presented a problem, as the valve-guides were threaded metric thread. It was, therefore, found necessary to re-tap the cylinder with standard thread and to make new guides all the way through. These guides were made with slightly smaller holes—all the valve-stems were dressed down with a very light cut in the lathe, so that it left them round and of uniform size up to the head. A new oiling system similar to that on the Beyster-Detroit had to be provided, although this motor was already equipped with an oil pump. This motor had large water outlet plates on top of the cylinder designed to provide for cleaning out the water-jackets. These plates were aluminum, and being subjected to constant contact with salt water, were partly eaten away. It was found necessary to replace them. For this purpose heavy sheet brass plates specially formed in the shops were provided. A great deal of other work was required, including bushing of idler gear, bushing of upper connecting-rod bearings, refitting of all the main bearings, etc., but as this is handled in the customary manner with which nearly all users are familiar, it will not be further dwelt on here.

Another interesting example that shows how a little thing can cause a whole lot of trouble is illustrated in the case of a 15-h.p. four-cylinder Buffalo motor. This was thoroughly overhauled, new rings were fitted and run in, new push-rods were supplied, valves were ground in, in fact every part was thoroughly gone over and still the motor would not give satisfactory service. After a careful examination it was found that the valve-stems were worn tapering. When the valves were closed there was no apparent play, but when they were open there was sufficient play to cause the motor to suck in air between the valve-stem and the valve-guides, thus spoiling the mixture in the cylinder. The valve-guides were part of the cylinder casting and were not removable. It was, therefore, found necessary to drill out these holes in the casting and to make and fit eight valve-guides in these enlarged holes. New valves were then fitted to these cylinders and the motor has given entire satisfaction ever since.

It is interesting in inspecting motors received from various patrons to discover the various causes which have led them to desire to dispose of the motor and secure a new one in its place. Of course there are many who simply trade in their motors to secure one of more power or of later design, but there are also those who, having experienced some trouble, and not being able to overcome it, decided to trade the engine in for a new one. It has been found in over 90 per cent. of cases of this kind that the trouble which led to the discarding of the motor was of some minor character and easily remedied in one or two hours of work. It is not, however, always as easy to discover the cause—especially for the inexperienced owner. A short-circuited timer firing two cylinders at one time is easily overcome, but is a source of much vexation to the owner, who cannot locate the trouble. A two-cycle motor assembled by a so-called mechanic who had put the pistons in with the deflectors over the exhaust port would offer a source of much trouble, although quite easily overcome in the shops.

However, in most cases, it is found that the trouble with used motors was slight and easily remedied by competent mechanics under a skilled and experienced foreman.

NEW FORM OF VOLTAIC CELL

A new cell, with electrodes of zinc and carbon in a solution of sal-ammoniac, has been in use in France, the electro-motive force being 1.18 volts per cell, with a weight of only 2.1 kilos for a cell giving 90 ampere hours. The negative electrode is a plate of zinc resting on the bottom of the glass containing jar, the copper wire connected to it is insulated up to a point well above the level of the solution. A carbon tube, about half the diameter of the jar, pierced with holes, rests on the zinc plate, being insulated from it by an ebonite cross. A wood cover retards the evaporation of the sal-ammoniac solution, which becomes acid at the lower portion owing to the deposit of dense zinc chloride, while the upper part becomes alkaline owing to the ammonia produced, the depolarization of the cell being effected by the air alone.

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"Motorship" Illustrated Patent Record†

Selected Abstracts of Recent Published Patents of Internal Combustion Engines

Copies of original specifications may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

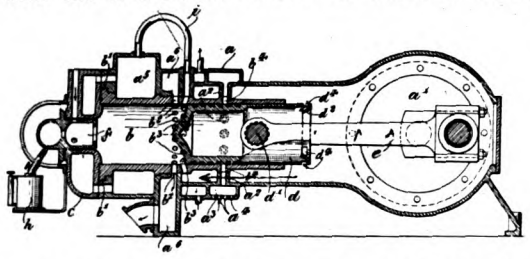
"MOTORSHIP" is offering with this new department to its readers a monthly selected record of patents in the internal-combustion-engine line, which we feel and we hope will be of the greatest interest to our readers as we particularly purpose by it to keep the prospective manufacturer, owner, designing and operating engineer posted, not only about what "has been" on the market, but also what are the newest inventions and what is the trend in the line of engineering which our journal is representing. In this department we are contemplating the publishing not only of the most recent patents, but also, from time to time, of patents which were granted some time back but which are yet employed on and are the principal features of engines of well known make and still on the market. In order to make this record still more valuable we will list foreign patents whenever they should embody basic principles in our line. In such a case the report will be without illustration, but we will refer the reader to the source of the respective paper from which we extracted the report.

†Compiled and described by H. Schreck, Member American Society Mechanical Engineers.

1,261,465. MEANS FOR AIR COOLING OF PISTON AND WRIST PIN

C. W. Weiss, of Brooklyn, N. Y.

This invention relates to an internal combustion engine in which the scavenging air is compressed in an enclosed crank case. When the piston is at its inner dead centre, air flows into the crank chamber through the openings a^3 and a^4, passes through the ports a^2 and b^4, and then through the ports d^4 of the outer end of the piston where the baffles d^2 direct



the stream of cold air against the wrist pin and the inner wall of the piston. On the return stroke of the piston this air is being compressed in the crank chamber and rushes into the cylinder upon the uncovering of the scavenging ports b^3, which are in direct connection with the crank chamber through ports formed between the lugs a^2. Steam is employed together with the fresh air and is taken from the steam dome a^5 of the engine frame. B^2 are the exhaust ports, and f is the vaporizing chamber where oil, air, and steam are being mixed.

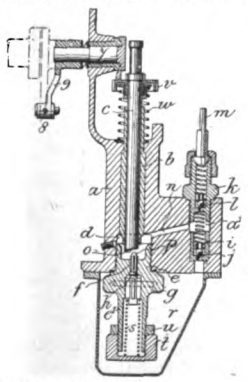
The inventor claims:

In an internal combustion engine, in combination with air inlet ports, a piston to control the inflow of air through the ports and a deflector ring provided with baffles carried on the open end of the piston whereby when the inlet ports are overrun air is directed into the piston to cool the piston and wrist pin.

1,263,839. FUEL PUMP WITH VARIABLE AMOUNT OF FUEL SUPPLY

V. G. Barford, of Basingstoke, England

The pump plunger is so shaped at its end that, by rotation of the plunger about its axis, it can, during its inward or delivery stroke cause at a definite but alterable point to open a relief valve f and thus relieving the pressure of the fuel discharge back into the suction or supply chamber of the pump.



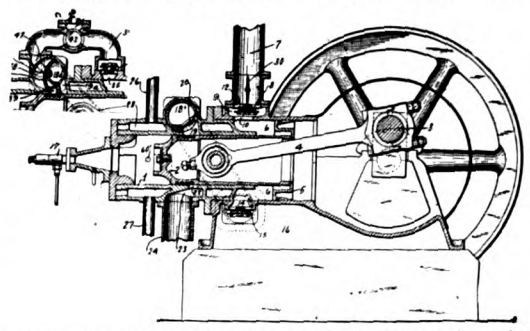
What the inventor claims is:

1. Apparatus of the kind herein referred to comprising a pump chamber, valve means controlling the inlet and outlet of liquid to and from said chamber, a plunger adapted to draw liquid into said chamber under control of said valve means, a relief valve and means associated with the inner end of said plunger and whereby said relief valve can be opened at a definite point in the delivery stroke of said plunger.

1,262,850. A TWO-CYCLE INTERNAL COMBUSTION MOTOR WITH PRECOMPRESSED AIR CHARGE

C. S. Salfeld, of Milwaukee, Wis.

A step piston is employed whose offset serves for compressing the scavenging air. This air is discharged through valve 15 to the receiver 16 in the base plate, which is in return connected to the chamber 18. The flap valve 10 of this chamber will be kept close during the expansion stroke of the piston owing to the pressure of the gases and only after these have been relieved through the exhaust ports 22, this valve



will be opened by the pressure of the scavenging air. This air will wipe out the rest of the burnt gases, and on the inward stroke of the piston after it has covered the exhaust ports, fill up the cylinder with precompressed fresh air.

This construction may be modified such that the step piston by respective arrangement of the air valves is supplying air at two different pressures, the lower of which for scavenging the cylinder and the higher pressure for supercharging the cylinder. In this case the chamber 18 is replaced by an automatically fluid operated corliss valve dividing chamber 18 in two compartments and the cylinder having two air ports 39 and 19a, instead of the one port 19.

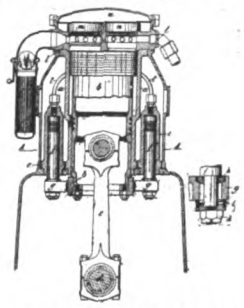
The inventor claims:

1. A two-cycle internal combustion motor provided with a combustion chamber, having inlet and exhaust ports adapted to be uncovered by the piston during its outward movement, a driving piston in said chamber, a compressing chamber, a fluid compressing piston therein connected to move in synchronism with the driving piston, a reservoir adapted to receive fluid from the compression chamber, a valve adapted to prevent return of such fluid to the compression chamber, a duct leading from said reservoir to the combustion chamber, and communicating therewith during, and subsequently to the period of delivery through the exhaust port, a valve controlling the delivery of fluid from said duct to the combustion chamber, and fluid controlled means for automatically actuating said valve in one direction as pressure in the duct increases, together with means for automatically reversing the position of said valve when relieved from fluid pressure control.

1,261,437. A COMPACT CONSTRUCTION OF COMPRESSOR

W. Reavell and E. W. Jones, of Ipswich, England

This type of compressor is intended where little head room is available, as, for instance, on the Diesel-engines of submarines. The invention refers to compressors of three or more stages. A step piston is



arranged for the first two stages and the other stages, or the high pressure stage only, are arranged parallel to the main cylinder. The pistons of the latter are by means of a flexible joint connected to a bridle piece which is carried by the main or trunk piston. The valves of the various stages are located together in the casting 1, which forms also the cover of the main cylinder.

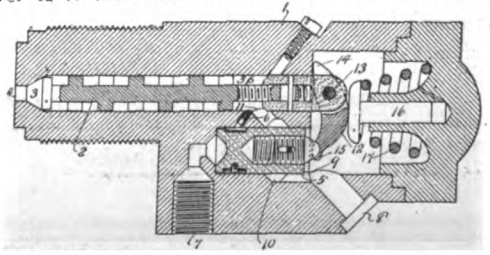
What the inventor's claim is:

1. An air compressor comprising a main cylinder, a valveless trunk piston working therein, two high pressure cylinders arranged parallel to and at opposite sides of the main cylinder, pistons working in said cylinders, a connecting rod extending into and connected to the main piston, a bridle piece rigidly attached to the main piston below the connecting rod connection and carrying the high pressure pistons, substantially as described.

1,262,400. FUEL INJECTOR

W. J. Still, of London, England

This fuel valve is operated by the pressure of the fuel pump which is delivering fuel during the required period only. The injection air is connected at 8 and the fuel at 7. The pressure of the fuel moves the plunger 5 which transmit its motion by means of the lever 12 to the needle valve 2. As soon as this valve



begins to be lifted the injection air starts to blow into the cylinder, and when the plunger 5 has moved sufficiently the fuel orifice 6 is uncovered and fuel and air will be ejected from the nozzle 4.

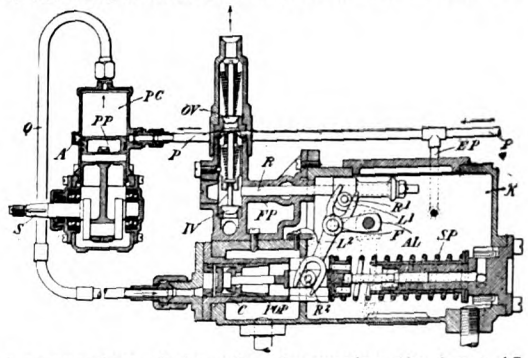
The inventor claims:

An apparatus for injecting fuel into a gas engine comprising in combination a casing having a jet opening and an air passage leading thereto, a valve member for normally closing said jet opening and arranged in said passage, said casing having a fuel orifice leading into said passage, a plunger adapted to be operated by the pressure of the liquid fuel and normally closing said fuel orifice, a lever for transmitting motion from said plunger to said valve member to open the valve, and a check valve for the fuel pump adapted to relieve the pressure behind said piston upon the intake stroke of the fuel pump whereby said piston is free to assume the position to cut off the said orifice.

1,263,886. FUEL PUMP WITH VARIABLE AMOUNT OF FUEL SUPPLY

L. B. Hall, of London, England

The fuel pump plunger R is operated by the forked swinging lever L^2, which is actuated in return by the pump operating piston POP. The virtual length of one of the arms of said lever may be increased, which will



decrease that of the other by moving the lever AL, and so, by changing this leverage ratio the stroke of the pump plunger is varied. The operating piston POP is operated by a pulsator, which provides the driving power by compressing and expanding its air volume.

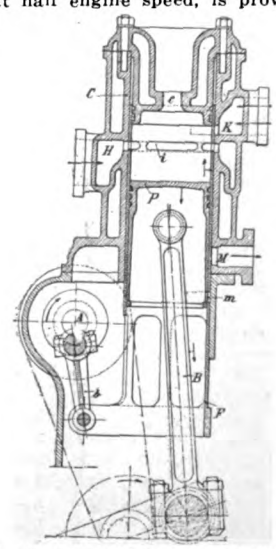
What the inventor claims is:

3. A fuel-supply device for internal combustion engines, comprising a pump having a piston for delivering liquid fuel to the engine to be supplied, a pulsator having a cylinder and a piston therein, a crank shaft for actuating said piston, a motor cylinder, a piston therein, actuating connections between said piston and the pump piston for actuating the pump piston, a pipe connected to the pulsator cylinder and the motor cylinder for delivering pressure to the motor cylinder for actuating the motor piston in one direction, a spring for moving said motor piston in the reverse direction, a connection leading from the pulsator cylinder to the intake for the engine, and a port communicating with said connection and the pulsator cylinder arranged to be opened near the end of the stroke of the pulsator piston, in order to equalize the pressure in the pulsator cylinder and the pressure in said connection, substantially as described.

1,261,058. SLEEVE VALVE ENGINE

G. E. Samain, of Paris, France

This invention relates to a four-cycle engine with ports for inlet and exhaust whose openings and closing are controlled by a sleeve F. This sleeve, which is running at half engine speed, is provided with an



anuular series of ports which, by registering with the ports of the cylinder, regulates the communication of it with the lower or exhaust port M, with the air inlet port H and with the upper port K for the entry of the explosive mixture. The greater part of the exhaust gases will escape thru the lower port M, thus relieving the engine from heat strain, and only the remainder of the burnt charge is escaping through the port K.

What the inventor claims is:

1. In a four-cycle internal-combustion engine, a cylinder having an exhaust port near its outer end, and inlet and scavening ports near its inner end, a piston, a sleeve between the piston and cylinder having an opening adapted to register with the exhaust port, and having a second opening adapted to register successively with the inlet and scavenging ports.

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